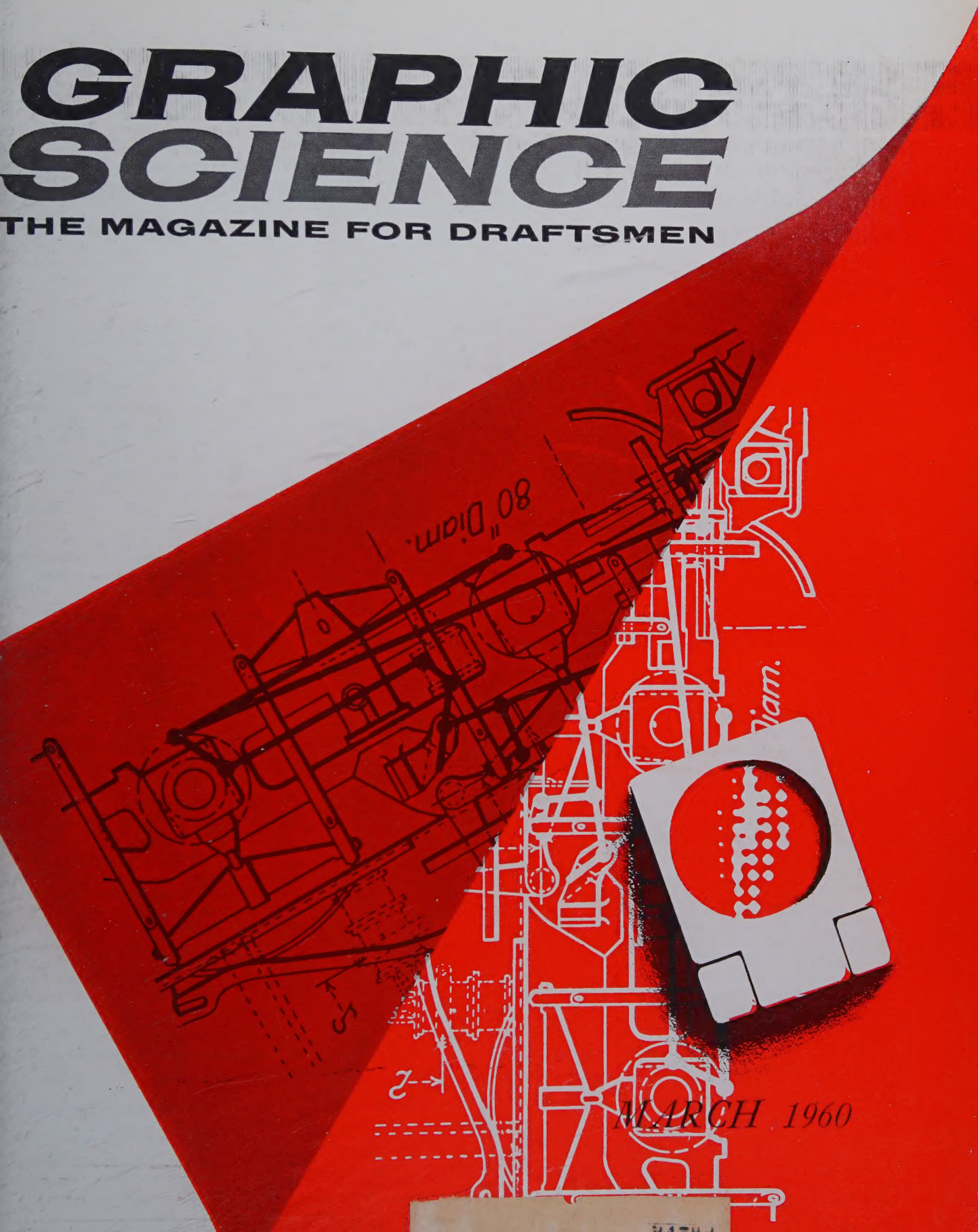
GRAPHIC SCIENCE

THE MAGAZINE FOR DRAFTSMEN

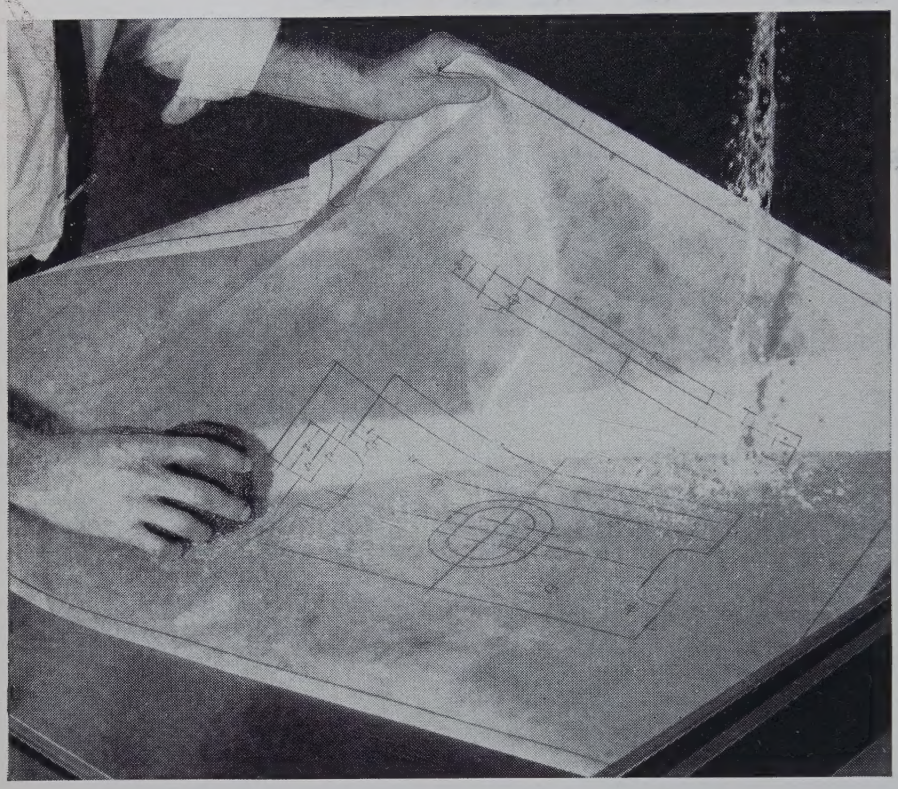


MARCH 1960

Some Ideas

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.



This badly-soiled drawing is getting a mild soap-and-water bath to restore its original printing quality.

Tracings you can wash! Mention this to a Chief Draftsman and you'd likely see his eyes light up as he perceives the implications of a simple new technique – one that's being used now by Raytheon Co. and could save them at least $50,000 this year. The secret: Herculene® Drafting Film by K&E, plus Staedtler Duralar plastic pencils –a completely washable combination, and the answer to . . .

A Dirty Old Problem

Functionally, an engineering drawing is only as good as the prints it will produce. This is a fact of life that governs any distribution-print system – conventional blueprints, white prints, or reduced-size prints. It holds true in a full-fledged miniaturization program, too. How long will an original tracing continue to produce top-notch prints? The answer depends on how much and what kind of handling it receives. Revisions, smudging, processing and filing all take their toll of a drawing's printability, decreasing it gradually – and sometimes quite sharply. As printing quality diminishes, some form of rehabilitation becomes necessary. But re-drawing – whether manual or photographic – can be costly and time-consuming. Drafting and reproduction experts have been wishing and working for a more efficient and economical solution.

A Simple Solution: Soap-and-Water

Washing became a possible answer with the advent of polyester-base drafting films and plastic pencils – and a practical reality with Herculene. This remarkable film combines a stable, waterproof Mylar® base with a completely washable surface for smudge-proof Duralar pencil lines – which *bond* to the Herculene surface and won't wash off.

Only the dirt washes away. There's no loss of line-background contrast, no loss of detail. The tracing can be restored to its original condition in a few moments – without re-drawing!

A Proved Money-Saver

To amplify an earlier point: the Missile Systems Division of Raytheon has been washing Herculene drawings for the past year, and now expects to save over $50,000 on re-draws alone in the year ahead. A large aircraft manufacturer has used the Herculene-Duralar soap-and-water method even longer, and reports impressive dollar savings plus an outstanding improvement in print quality.

In 6 months of testing and 14 months of actual drafting-room use, Raytheon engineers exposed Herculene to all basic trials – and a battery of fiendishly extreme conditions. They scored Herculene with a sharp scriber, but couldn't remove the matte surface. They taped a sheet to the floor and had a 200 pounder roll over it in a swivel chair during an active day. Herculene was baked and frozen – and doused with hot coffee – with no effect on its surface. After two hours, the coffee stain was washed off without a trace. Results of these torturous tests were so favorable that now, Raytheon's Missile Systems Division uses practically no drafting film *but* Herculene!

A Note of Caution

There are other waterproof drafting films, but plastic pencil lines will wash off some of them. So, when comparing polyester-base films, it's best to check them for *pencil line washability*. And another point – don't try this technique with ink or graphite lines – use only the Duralar K1 or K2. Even if you don't want to adopt the washing technique immediately, you're free to make the change at any time if you use Herculene – the *indestructible* drafting medium with the washable, engineered surface.

More Merciless Testing Invited

We'd be pleased to send you a sample of Herculene, and we invite you to do your best to ruin its excellent drafting and printing quality. The Herculene sheet comes in a small folder with complete instructions and a water-fast Duralar pencil – which K&E engineers helped develop for use with washable Herculene Drafting Film. Mail the coupon below for your sample!

KEUFFEL & ESSER CO., Dept. GS-3, Hoboken, N. J.

Please send me further information about the washable tracing method, plus a sample sheet of Herculene Drafting Film and a Duralar pencil.

Name & Title_____

Company & Address_____

_____

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GRAPHIC SCIENCE

THE MAGAZINE FOR DRAFTSMEN

MARCH 1960

VOLUME 2 NUMBER 3

THIS ISSUE: 13,000 COPIES

ARTICLES

DEPARTMENTS

GRAPHIC SCIENCE—offering complete coverage of drafting, technical illustration and reproduction for chief draftsmen, supervisors and instructors.

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Letters

Oceanographic Drafting

Sirs:

It was with great pleasure that I received your fine magazine GRAPHIC SCIENCE in my mail box last week. I took it home and practically read it from cover to cover at one sitting, including the advertisements, which I found most informative.

The magazine couldn't have come at a more opportune time, although I have been at the Oceanographic for five years I have just recently been put in charge of their drafting room, consequently the two articles in the December issue, "Recruiting and Training Draftsmen" and "Procedures for Drafting Supervisors" couldn't have suited me any better.

I have been in the drafting profession for eleven years starting out as a mechanical draftsman and getting into cartography and now electronic and report drafting. I have often realized the need for a publication such as yours to keep up with new ideas and mediums.

Oceanography with quite a varied cross section requires drafting in all its classifications. Quite often in preparing figures for the scientists for various journals and publications I have wished for a publication such as yours where one could submit articles for possible publication about drafting methods, techniques and materials developed or used here. Some of our work is even done at sea.

Thank you again for your December issue and I will look forward to future issues. I assure you they will be read by our draftsmen as well as the many interested scientific people here at the Woods Hole Oceanographic Institution.

CHARLES S. INNIS
Woods Hole Oceanographic
Institution
Woods Hole, Mass.

Shorthand

Sirs:

I cannot thank you enough for this type of magazine designed for draftsmen. There has been something missing in our profession and your magazine seems to be the answer toward getting this forgotten profession some recognition.

I would like to see an article on short hand drafting, pros and cons.

May I wish you continued success with GRAPHIC SCIENCE.

DUANE AYRES
Chief Draftsman
McGraw Edison
Chicago 38, Ill.

Drafting Supervision

Sirs:

I have read with interest the December issue of GRAPHIC SCIENCE which you sent to me, and have found the material contained therein to be most interesting and informative. Mr. Schmidt's article on "Operations and Procedures for Engineering and Drafting Supervisors" is outstanding and one of the best I have ever read on this subject.

If I am found qualified through the enclosed application to continue to receive your magazine, it is my intent to circulate each issue to all my supervisors as I believe they also will find it most interesting and informative.

Thank you and best wishes for a happy and prosperous 1960.

E. E. BIANCO
Supervisor, Power Transformer
Product Design Drafting
General Electric Co.
Power Transformer Dept.
Pittsfield, Mass.

Orthographic-Isometric

Sirs:

First of all let me congratulate you on putting together a fine and informative magazine. I am a packaging engineer and do most of my own drafting, and so I am grateful for a forum where ideas concerning this vital work are passed about.

In this vein, Mr. Wayne L. Shick's article certainly set me upon a path I did not know existed, and I think will save me many weary hours stretching out ahead. I always work in the three dimensional and find that

(Letters to the editor should be addressed to 103 Park Avenue, New York 17, New York. Names will be withheld upon request but all must be signed.)

Direct-process print made from Kodagraph Autopositive Film photo-drawing makes details of complicated equipment easy to understand

One picture better than 1,000 lines

Low-cost photo-drawings save countless hours of redrafting, improve communications, speed construction

"Let's take some pictures"—that's the first step today in many drafting rooms *when* additions or revisions are called for in existing equipment; *when* equipment layout drawings must be made from engineering models; *when* assembly, wiring, or piping plans for machines or products must be created from a prototype.

After pictures are taken on these jobs—and countless others—it's an easy operation for your printroom or local blueprinter to make positive intermediates which combine desired negatives and your drawing forms.

Every detail on these prints is accurate, up-to-the-minute, and in desired perspective—easy for anyone to visualize. Just add dimensions, connecting lines or other new detail and your photo-drawing is ready.

Free booklet gives interesting details on photo-drawing techniques and the savings they make possible. Send for your copy today!

Graphic Reproduction Division, Eastman Kodak Company, Rochester 4, N. Y.

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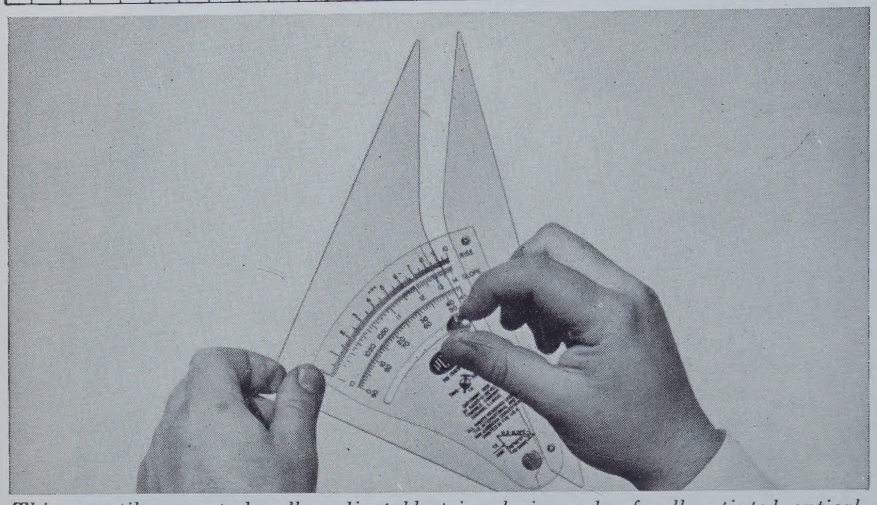
DRAFTING TRENDS



This versatile, easy-to-handle, adjustable triangle is made of yellow-tinted optical-grade acrylic plastic. A clean-cut oval track fitted with metal knurled knob assures ease of operation and lasting tight fit.

New combination protractor-triangle speeds up drafting

Architects, Engineers, Builders, Field Surveyors, Mathematicians—anyone who develops solutions to measurement problems indirectly to determine a wanted measurement graphically or mathematically—will find the Trig-Matk Adjustable Triangle a handy tool. It eliminates much of the graphic work necessary in estimating results or in checking for correct answers.

Versatility with accuracy

Basically the new POST Trig-Matk Adjustable Triangle is a mathematician's tool—accurate to three decimal places.

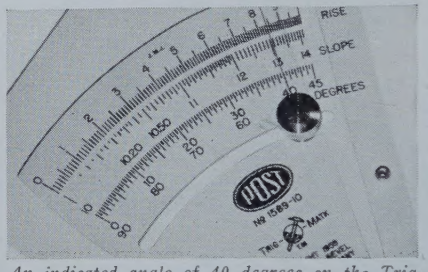
It combines the functions of a protractor and a triangle into a simple unit, with two fundamental trigonometric relationships of a right triangle. The Trig-Matk provides accuracy within 0.1% in problems dealing with any of the six trigonometric ratios of the sides of a right triangle.

The adjustable protractor has three sets of graduations. One set is graduated in half degrees, labeled *Degrees*, and permits the use of the Trig-Matk as a protractor setting for determining any angle from 0 to 90 degrees.

The second set of graduations, labeled *Slope*, shows directly the *Secant* trigonometric ratio of the angle indicated on the degree scale. The third scale, labeled *Rise*, indicates directly the *Tangent* trigonometric ratio shown on the degree scale.

Examples

This new tool has a host of drafting and engineering applications. Highway designers find the Trig-Matk very useful when making cross sections of roadways at ground level or below. By



An indicated angle of 40 degrees on the Trig-Matk (1589) shows directly that the Rise is 8.4 to the base of 10.

setting the *Slope* scale to the degree desired, road-curve grades are automatically determined. The protractor can be used to determine the angle of highway ingress and egress lanes.

Structural Engineers will find the Trig-Matk Adjustable Triangle a simple tool, eliminating the use of both a scale and individual triangles. In addition to the time saved, many of the errors usually associated with the older method are avoided. The Trig-Matk design eliminates the need of frequent reference to handbooks for information on various bevels.

Two Bases

The Trig-Matk No. 1589-12 has a 12″ base scale for handy calculation in terms of feet and inches. Number 1589-10 has a metric base scale of 10.

Keep posted on all the latest trends in drafting. Consult your local POST dealer, or write to Frederick Post Co., 3656 North Avondale Ave., Chicago 18, Ill.

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Letters

most people who are untrained in blueprint reading (and this includes practically all the people I deal with) cannot visualize the final package. I always make isometric drawings for them and isometric drawings for my layout men. This also proves-up my sketches so that we can see at a glance if tabs, scores, diecuts, and the like are properly placed. This new (to me) method of orthographic-isometric projection will prove up my drawings as they are being drawn.

I use a small portable drafting machine, and would like to adopt my unit to Figure Six but I'm afraid that I'm too thick to understand how this works. If it isn't too much trouble, could you have Mr. Shick explain this in a subsequent note?

ARTHUR HARRIS
Foam Form Sales Co.
Jamaica, New York

Editor's Note: Professor Shick, Editor, Journal of Engineering Graphics replies below. The article by Professor Shick to which Mr. Harris refers appeared in the December issue, and was entitled "Integrated Orthographic-Isometric Projection."

Sirs:

To answer Mr. Harris' query: The purpose of positioning pins on the board and the slot in the quadrangle on its underside is to guide the quadrangle along the imaginary mitre line formed by the intersection of projection lines between any two orthographic views. These imaginary mitre lines are shown in Figure 4 (Page 18, December issue GRAPHIC SCIENCE) also.

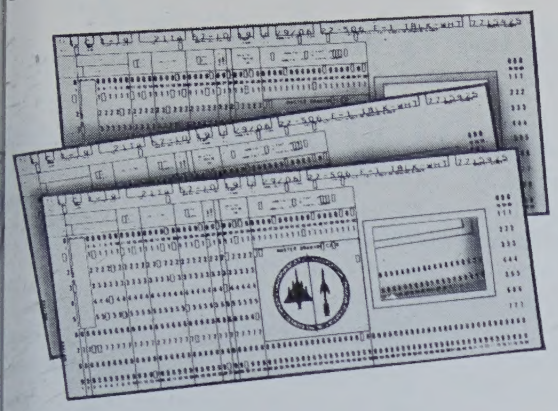
WAYNE L. SCHICK
Professor of General Engineering
University of Illinois
Urbana, Illinois

National Organization

Sirs:

I personally feel that a national organization for draftsmen is a must. Would like nothing better than being a part of such an organization and having your magazine as the voice.

GEORGE H. HEINS
Knoxville, Tenn.



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Notes & Comment

LAST MONTH'S COVER (Square Peg-Round Hole) was designed by Dave Lewis, New York free-lance artist; this month, Allan Eitzen interprets the reproduction theme of this first special issue of GRAPHIC SCIENCE.

Two other special issues will appear this year. The first of these, on the many aspects of developing good draftsmen, will appear late this spring. Training programs in industry and the teaching of drawing in schools and colleges will be included. The second, on drafting room organization, layout, and equipment, will appear early in the fall.

Next month, watch for two unusual articles. One by noted architect Harold R. Sleeper is an interesting presentation of the development of his now classic *Architectural Graphic Standards.*

The second is a report of the drafting department at Perkin-Elmer, a leading manufacturer of optical and precision equipment. Ralph Scalo, supervisor, tells the story in his own words.

Our apologies to Jay Bergen, Associate Editor, from printer, proofreader and near-sighted editor for the typographical error that crept into his editorial last month. For the books, one half of 0.001 is still 0.0005!

Mapping & Photogrammetry

THE 20th Annual Meeting of the American Congress on Surveying and Mapping will be held at the Shoreham Hotel, Washington, D. C., March 20-23, according to Convention Director Thomas A. Hughes. This meeting is held immediately preceding the 26th Annual Meeting of the American Society of Photogrammetry, March 23-26 at the same place. Items of interest include a paper to be presented by USAF Aeronautical Chart and Information Center on Planning for Cartographic Automation, and an article on An Automatic Type-Placement System by Charles W. Schlager, Army Map Service. Emiel N. Bernard, Unitech Corp. will present a paper on Scribing on Coated Foil and Coated Glass with Coordinatographs. At the Photogrammetry meeting, Frank McWilliams, Aero Service Corp., will announce an Automati Coordinate Plotter. For more informa tion: Vance A. Rogers, Chairman Publicity Committee, 5201 Wissio ming Rd., Washington 16.

Here & There

SCALE MODELS of proposed plant in three dimensions have pro duced important savings in construc tion costs by revealing flaws not evi dent from engineering drawings, ac cording to a note in *Chemical Digest* publication of Foster D. Snell, Inc According to a piece in the *New Yorker* about Max Beerbohm, it wa one of his wishes to have a museum of unfinished masterpieces, among them the original drawings for the Tower of Babel! The current issue (February 6 at this writing) also ha a gem in The Art Galleries, a column by Robert M. Coates describing the kinetic constructions and *drawing ma chines* of a Swiss "artist" Jean Tin guely. Coates' description: "The 'draw ing machines' are even more involved contraptions, made up of parts tha whirl and jerk at a frantic rate, brandi ishing a crayon mounted in a stylu at the end of a flailing flexible arm which, when set in motion, rapidly dabs dots, streaks and squiggles o color on a sheet of paper placed be fore it." No comment.

Heard and Remembered

A SPOKESMAN for a mid-western firm recently said, "In our com pany it was necessary in transferring a rather large group of blueprints from one factory to another to have those responsible in the two factories sit down together and translate the blueprints from one factory's drafting practice into the drafting practice tha was being used by the second."

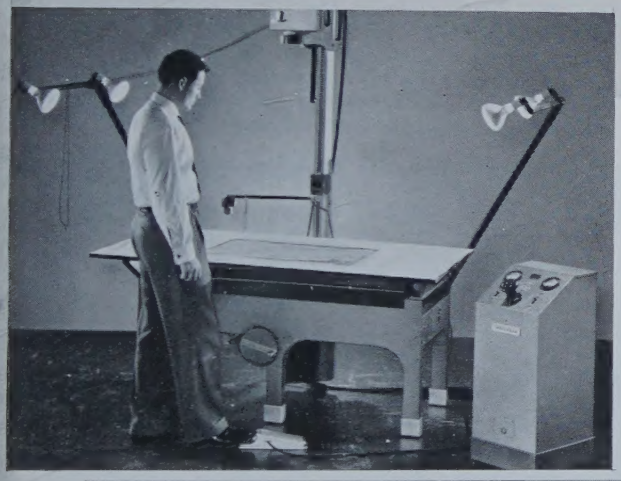
Standards and Such

EVER HEAR OF MIL TXX-42? Neither had an engineering departmen head we knew, who called up the cli ent to find out. "Would you mind tell ing me what MIL TXX-42 means?" he asked. "Sure, I'll tell you," the cus tomer said. "It means make it like the blankety-blank-blank drawing fo once!" And now he knows.

"Any drawing out of thousands found in a minute or less!"

See how Recordak Precision Engineering Drawing System speeds engineering and drafting routines for Cook County, Illinois, Highway Dept., now engaged in a multi-million-dollar highway expansion program.

Mr. F. A. Cerwin, Record Administrator, looks over Recordak Microfilm file, now the *active* drawing file for Cook County Highway Department



FIRST STEP for Cook County was to put its tens of thousands of drawings on 35mm Recordak Microfilm, using techniques and quality-control methods developed by Recordak through years of research. The resulting negatives are needle-sharp images with remarkably uniform backgrounds. Mounting each frame in its own Filmsort aperture card completes job.

RESULTS: New "microfilm" drawing file takes 95% less space. Makes reference in film reader a snap. Ends need for costly reference blueprints that clog up the files! Reduced-size paperprints, when needed, are made by photographic, xerographic or electrostatic methods. Another advantage: a positive film copy of master negatives provides a security copy at negligible cost.

Free booklet—"must reading" for every draftsman and engineer—gives details on this new system available through Recordak and its nation-wide dealer organization.

RECORDAK®

(Subsidiary of Eastman Kodak Company

originator of modern microfilming
—now in its 32nd year

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415 Madison Avenue, New York 17, N. Y.

Gentlemen: Send free booklet describing new Recordak Engineering Drawing System. No obligation whatsoever.

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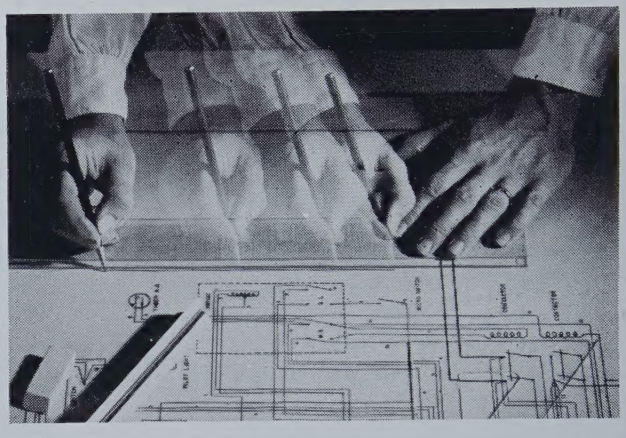
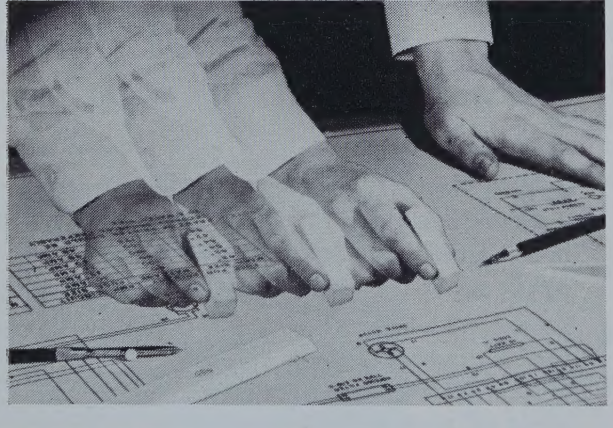
NEW! CRONAFLEX® DRAFTING FILM

The best surface on the toughest base . . . made and controlled by Du Pont from start to finish.

1 CRONAFLEX Drafting Film has excellent pencil acceptance. Its superb matte surface accepts printing and drafting inks.



2 CRONAFLEX Drafting Film erases easily, without ghosting, yet there is less smudging. It comes matted one or two sides, and is available in either rolls or sheets.



3 CRONAFLEX Drafting Film is .004" thick, which has been found to be ideal for drafting. Its rugged CRONAR* polyester film base will take repeated handling and countless trips through your reproduction machine and to and from your file drawer without cracking or becoming brittle. It lies flat, holds size, is flexible and impervious to moisture.

CRONAFLEX Drafting Film is the first product of its kind which is made in its entirety by a single manufacturer. The benefits can be summed up in two words: quality control. We control the manufacture of both base and surface, and we control the method by which they are made into the best drafting film you can buy.

This means that every sheet of CRONAFLEX Drafting Film has the same excellent pencil acceptance, the same erasability, the superb matte surface, the .004" thickness which has been found ideal for drafting and filing.

If drawings are made anywhere in your operation, you can use CRONAFLEX Drafting Film to great advantage. CRONAFLEX Drafting Film joins the widely acclaimed CRONAFLEX line of films: Direct Positive, Contact and Projection. You can go from original drawing to final reproduction with the same product line on the same strong base. For more information write: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont of Canada Limited, Toronto.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

**Du Pont's trademark for its polyester photographic film base.*

A Microfilm Drafting System For the Small Engineering Department

Gradual acquisition of equipment, plus some revisions in drawing standards, make microfilming practical for the small firm

by V. F. Dugar

PERHAPS EVERYONE IS aware by now that today's concept of microfilming as applied to engineering drawings had its beginning in the security files. With many hours and dollars tied up in relatively fragile paper and cloth drawings, some means of insurance against loss by fire or theft had to be found. The requirements of such protection may be summed up in three basic points:

1. The records must be permanent.
2. The records must be confined to a small space.
3. The system must be relatively inexpensive.

The idea of photographing these drawings in sequence on a strip of film with the images greatly reduced proved to be "exactly what the doctor ordered" to meet all three requirements. Countless thousands of drawings and documents could be placed on film to be securely stored away in a relatively small space in underground vaults.

Lenses with high resolving power, and film having a very fine grain made possible the practice of microfilming, of putting large drawings with considerable detail into a very confined space. Here for the first time we were able to "condense" the information contained on a large drawing into a space small enough to be mounted on a card.

Once stored in strip form, the filmed data could be retrieved by viewing on a machine specially designed for the purpose and an operator could play-back the information by turning to the right spot on the film strip. Today more sophisticated machines permit not only viewing but automatically printing a blow-back, enlarged image on paper. Additional ease of handling and retrieval can be had by mounting each micro-image on a separate card identified by printed data in the margin or by even more sophisticated key-punching for automatic machine sorting.

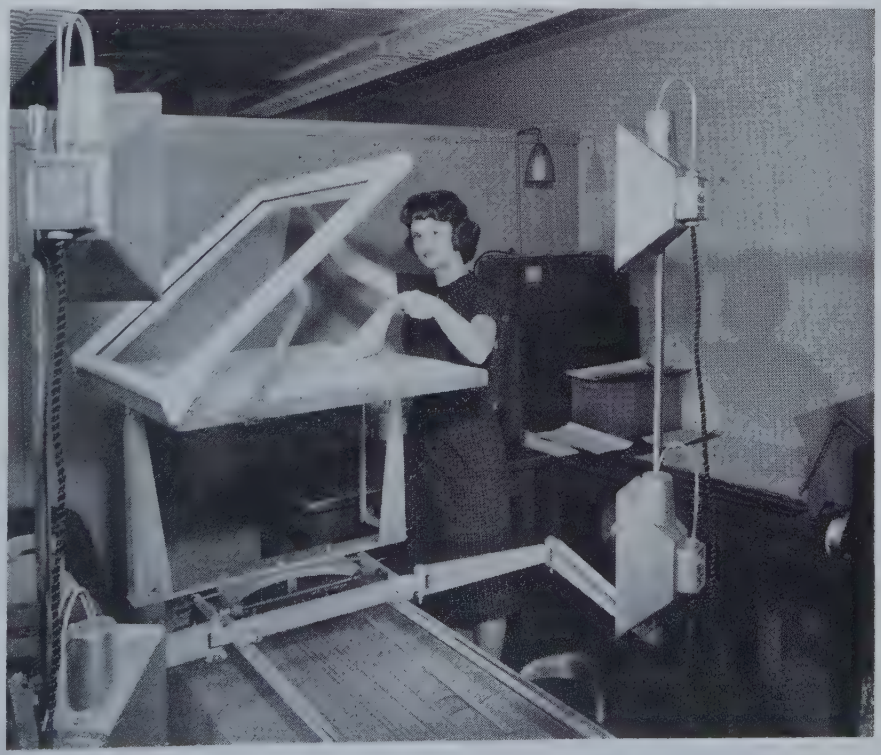

FIGURE 1. At Reliance Electric and Engineering Company, operator mounts "D"-size wiring diagram original. Camera copy board is in loading position.

Editor's Note: This article is based on a paper presented by the author at the annual meeting of the Technical Drawing Associates, held in October 1959 at Rochester, N. Y.

The immediate reaction to all of this is to say, "Wonderful! Let's scrap our old system and convert our operation to microfilm." So an investigation to learn more about what is required and what it will cost is diligently begun.

Problems

Two problems immediately confront us: (1) Many drawings, so painstakingly made with much care and hard work, are unsuitable for microfilming. Lines are too light, and lettering is either too small or too slanted. The bulk of our drawings are wiring diagrams on "D"-size, 22" x 34" sheets. We discover that while we might get by with the first generation, successive reproductions do not give us acceptable line quality when blown back to original size. (2) As a small engineering department working on a limited budget, we discover that cameras, film processors and duplicators, printers, viewers, and files, are all essential but too costly for immediate and complete conversion.

Procedures

Our engineering instinct tells us to compromise, to begin with that part of the program that is immediately accessible and, at the same time to pave the way for eventual 100 percent microfilm operation.

At Reliance Electric & Engineering we were confronted with this exact situation. This is what we did.

Recognizing the long-range potential of producing "tailored" engineering drawings we immediately set up new Standards so that every drawing produced after October 1 of 1958 meets the requirements of image reduction. These Standards were patterned closely after the recommendations presented by William J. Gallagher and Carl E. Nelson of Bell Telephone Laboratories at the National Microfilm Association Convention, held in New Orleans, Louisiana, in April, 1958.*

Basic Equipment

A careful study revealed that the substantial savings of $20,000 per year could be realized by making reduced-size masters from these drawings by Xerography, and by running off file prints on our offset printers.

*Messrs. Gallagher and Nelson's paper, **Drafting Standards for Microfilmed Engineering Drawings,** was subsequently reprinted in FILMSORT FACTS, a publication of Filmsort Co., Pearl River, New York, a division of Minnesota Mining & Mfg. Co.

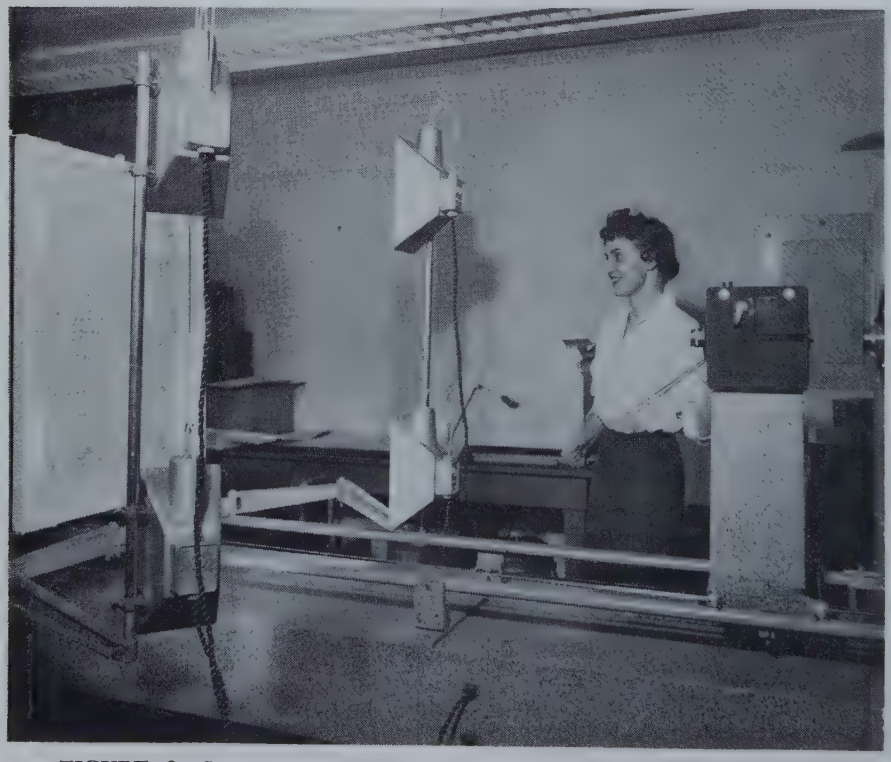

FIGURE 2. Operator takes microfilm picture of wiring diagram. Note process camera lens at extreme right for sequential Xerox photo copy operation.

To put the savings program "on the road," entailed the purchase of a larger Xerox process camera, and here is where we made our first positive advance in the direction of microfilming conversion. We adapted the process camera bed to take a special carriage suitable for mounting a C-3 microfilm camera head, so that with one mounting of the drawing original on the copy board (see Figure 1) we could take the Xerox shot and the microfilm shot in succession (see Figure 2).

By this process we immediately established security copy on microfilm.

System Completion

Through the facilities of local agencies, we may process and obtain copies of the microfilm originals for subsequent mounting on cards.

A filing system may be readily adapted around our present drawing record card files. The reduced - size copy produced by offset printing is, through acceptance, paving the way for similar reduced - size prints produced by newly - developed electrostatic printers operating from microfilm cards.

Print handling and distribution may be readily supplanted by suitable card duplicators and readers with their attendant advantage of convenience and space saving.

All that remains to complete the transition is a further reduction of equipment cost. We anticipate this will come about quite naturally through a more universal acceptance of the concept that a microfilm engineering drawing system is not only desirable and practical but also attainable in every respect.

Conclusion

Every engineering department both large and small, can enjoy the use of such a system if the transition is made self-sustaining on a pay-as-you-go basis.

The Author

V. F. Dugar is Chief Draftsman, Control Division, Reliance Electric and Engineering Company, 24701 Euclid Ave., Cleveland 17, Ohio.


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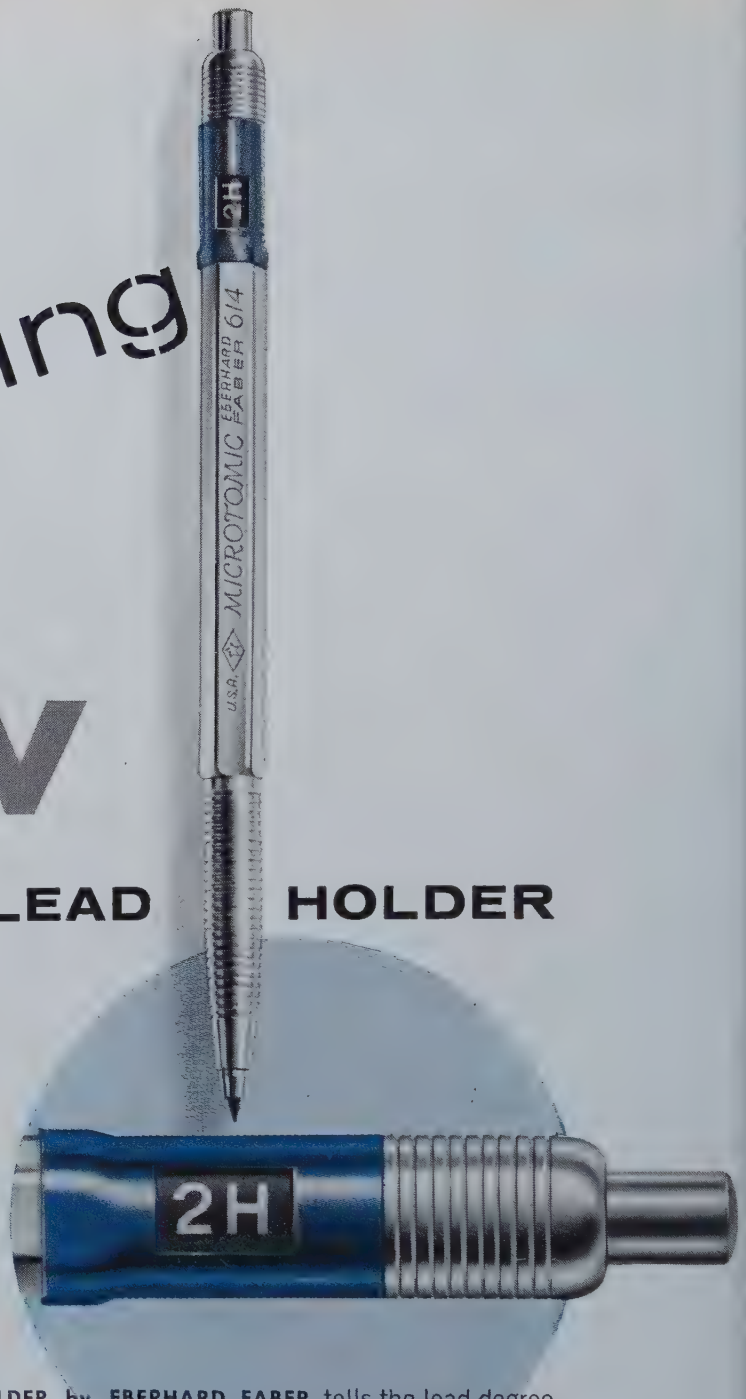

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Microfilming and Management of Engineering Documents

Department of Defense standardizes on a microreproduction system to handle huge body of data made up of engineering drawings, materials lists, specifications and standards

by William S. Hutchinson

EFFICIENT MANAGEMENT of engineering documents has for the Department of Defense, considerable importance in carrying out the military mission. The "lead time" from conception of a new idea to operational weapons continues to increase at a rapid rate.

In 1940, for example, it took 17,000 manhours to build a military fighter plane. Now it takes about 2-million hours. To design, develop, test, and construct a jet fighter or bomber takes up to 7 years. Measures that will reduce this "lead time" are essential to the United States, in forging ahead in the race to produce the most advanced deterrent weapons.

Building today's complex weapons requires large numbers of drawings. Guided missiles require 15,000 or more drawings. It takes 18,000 drawings for jet fighters and 30,000 drawings for heavy tanks. Advanced space vehicles and their navigational systems now in planning stages may require upward of 100,000 drawings.

Active drawings of the Armed Forces, including those of military contractors, total nearly 50 million, and new drawings prepared each year now reach 6 million. These new drawings cost about $1.5-billion annually. Another half-billion dollars represents the cost to reproduce copies for engineering, procurement, production, maintenance, and other purposes.

Editor's Note: This article provides industry with an accurate portrayal of Defense achievements in the important area of engineering drawings, their microreproduction and management. It presents the procedures and requirements surrounding the military aspects of microfilming engineering documents.

The Problem

FOR YEARS, reproducing original drawings by conventional methods resulted in the common usage of full-size prints. Ranging in sizes up to 40 by 50 inches, with rolls reaching 12 feet in length, these prints presented handling difficulties. The Armed Forces, with extensive files, finds such drawings inadequate, principally because: (1) Massive volume makes location of data difficult. (2) Manual retrieval of data is slow. (3) Formats untailored for machine systemization restrict data manipulation and usage. (4) Bulky storage uses excessive space and filing equipment. (5) Reproduction and distribution consume excessive time and incur great expense.

The Department of Defense had to solve these problems. How could engineering documents be stored more compactly, be located and reproduced speedily when needed, and be interchanged readily among the Armed Forces and their contractors?

Also, how could engineering data, once generated, be made available for wide usage by all military activities having a similar need?

The Program

THE STANDARDIZATION Division, Armed Forces Supply Support Center, in 1957 initiated a major Defense program to identify and then to study problems concerning the management of engineering documents. That program was divided into three phases, as follows:

Phase I examined all procedures employed for preparation and procurement of engineering documents. This analysis revealed 158 overlapping and duplicating specifications in use throughout the Armed Forces. Lack of standardization was costing the Government millions of dollars annually and wasting valuable time. The differing specification requirements placed on contractors the frustrating burden of maintaining parallel drafting rooms for each military activity, just to satisfy the special procedures of each.

Achievement of unified drawing and associated data requirements during Phase II cost approximately a half-million dollars, shared equally by the military and industry. Industry, national associations, technical societies and universities ably assisted in developing a single coordinated document covering all Defense requirements. Military Specification MIL-M-70327, entitled "Drawings, Engineering and Associated Lists" now provides the exclusive authority for procurement. This specification invokes Military Standards governing drawing practices in addition to drawing types, sizes, numbering, nomenclature, materials, and reproduction.

Phase III (in process) groups

problems on management aspects of engineering documents, including the following subjects:

- Microfilming of drawings and associated lists
- Rapid transmission of engineering data
- Unified drawing control system
- Standard format lists for materials with machine compatability
- Minimum adequate storage and protection of drawings
- Uniform technical manual series
- Uniform method for approval of non-standard parts
- Uniform order of precedence of parts for design selection

Priority

Recognizing the increasing need to interchange drawings, the Armed Forces assigned to microfilming a high standardization priority. In August 1958, Department of the Air Force received the assignment to undertake an initial study in determining "Department of Defense Requirements For Engineering Drawing Microreproduction System." Later expanded in scope, the study included all forms of engineering documentation as defined in Military Specification MIL-D-70327.

The survey disclosed that microfilming programs had been completed by some services, while others were in the process of converting, and some were awaiting further developments. Considerable variation was discovered in the procedures, formats and sizes.

Military working groups, organized to study separate parts of the overall problems, gave first attention to review of the 44 existing specifications covering microfilming requirements. Specification consolidation has resulted in one set of Defense requirements under the following document titles:

Proposed Military Specifications

- Microfilming of Engineering Documents, 35MM, Requirements For (Draft MIL-M-9868)
- Cards, Aperture (Note: Cards without microfilm or data)
- Cards, Tabulating and Aperture, For Engineering Data Microreproduction System, Preparation Of.
- Photographing of Construction Drawings and Maps, 105MM, Requirements For

Proposed Military Standards

- Formats and Coding of Tabulating and Aperture Cards For Engineering Data Microreproduction System (MIL-STD)
- Gage, Aperture Card, #201-1 (MS Standard)

Defense officials realized that to achieve realistic standardization in so broad an area as engineering documentation would require technical "input" from the whole of industry. They sought the assistance of both engineering and reproduction organizations. Many companies responded and are cooperating with the Armed Forces in establishing a workable system. An *ad hoc* industry advisory committee met during July 1959 to review drafts of the above military specifications and standards.

A second *ad hoc* industry advisory meeting is scheduled for March 1960 to complete the military specifications and standards covering 35MM microfilming and aperture cards.

Documentation Status

The military documents covering requirements for 35MM microfilming specify the following tentative features:

(1) Microfilming of Engineering Documents, 35MM, Requirements For, Proposed Military Specification MIL-M-9868

Scope: This specification covers the microfilming of engineering documents by the Department of Defense or by contractors. Microfilm produced in accordance with this specification shall be 35MM roll (unperforated) microfilm.

(2) Film, Photographic, Microfilm (Black and White), Proposed Interim Federal Specification

Scope: This specification covers the requirements for sensitized (non-perforated) 35MM microfilm of the gelatin-silver halide type emulsions coated on flexible transparent supports.

(3) Film, Diazotype, Microfilm, Proposed Interim Federal Specification

Scope: This specification covers the requirements for sensitized diazotype 35MM (non-perforated) microfilm of the diazonium salt type emulsions and couplers coated on flexible transparent supports.

(4) Cards, Aperture, Proposed Military Specification

Scope: This specification covers aperture cards for mounting microfilm images on engineering documents prepared by the Department of Defense or contractors.

(5) Cards, Tabulating and Aperture for Engineering Data Microreproduction System, Preparation of, Proposed Military Specification

Scope: This specification covers the entry of data into tabulating and aperture cards and the mounting of microfilm images of engineering documents into aperture cards for use in the Department of Defense Engineering Data Microreproduction System. Requirements are specified for procedures and tests covering classes of microfilm to be mounted, mounting, adhesion, non-blocking, thickness, entry of data on cards, etc.

(6) Formats and Coding of Tabulating and Aperture Cards for Engineering Data Microreproduction System, Proposed Military Standard

Scope: This standard establishes formats for tabulating and aperture cards applicable to the Department of Defense Engineering Data Microreproduction System. These standard formats for tabulating and aperture cards are for use in recording engineering documents as defined in Specification MIL-M-9868. The standard also covers the codification and method of data entry into the engineering data tabulating and aperture cards.

Microfilmed Data Usage

Selection of 35MM microfilm (roll and unitized) as the standard size for engineering document microreproduction provides the Armed Forces with the base necessary for attaining a single compatible system. The standard format tabulating and aperture cards provide a compact and economical means for mechanized storing, retrieving and reproducing of engineering documents, with interchange capabilities not presently available.

In each of the bureaus, services and commands of the Armed Forces, the following types of activities have day-to-day uses for engineering documents:

- Repository (original or first copy)
- Source coding and provisioning

Plant and government inspection
Drawing and specification files
Standardization and cataloging
Research and Engineering (design, drafting, testing & evaluation)
Production (manufacturing, tooling & gaging)
Procurement and supply
Maintenance, repair and overhaul
Construction
Foreign military assistance
Disposal (recoverable, excess & obsolete articles)
Shipping (packing, packaging & marking)

The Department of the Air Force, to cite one service, presently is converting engineering data requirments for USAF materiel to aperture cards under the MEDAL Program. (MEDAL is the abbreviation for "Micro-Mechanized Data for Automated Logistics.")

In an Air Force survey to establish requirements for the MEDAL Program, it was found that 1000 blueprints required 9.56 cu. ft. of file space. The same drawings in microfilm aperture card form required only 0.139 cu. ft. of space—a 70-to-1 storage space reduction. A single foot of drawer space can store 1700 aperture cards, while one rotary file can hold a total of 135,000 cards.

Data Management Aspects

Standardizing the microreproduction of engineering documents on a defense-wide basis represents a major step toward achieving efficient data management. Although this may not be the ultimate solution in compressing the time cycle for obtaining data, this first achievement brings significant benefits to the Armed Forces, as follows:

1. It reduces handling and storing of many different sizes of original drawings, drawing reproducibles, reference prints, and paper stocks to one standard (miniaturized) card size.
2. Unitized microfilm (single frame with individual image) can be located faster in active files than by searching rolls of film (containing thousands of drawings) for the image needed.
3. Receipt of original drawings in roll or unitized microfilm form eliminates the delivery of paper prints by contractors.
4. It assists in reducing duplicate design and tedious selection of parts and components already tested and proven in existing equipments.
5. It eliminates separate numerical and alphabetical card files for drawings and lists because the aperture card is used for both the index file and the intermediate for making copies.
6. Tabulating and aperture cards make possible more accurate and up-to-date files, as they can be sorted and collated for EAM machine editing.
7. Increased accessibility of data in aperture card form increases use of specialized files; speeds accurate search for data; aids engineering evaluation, as aperture cards can be coded for retrieval under categories, such as, *a.* subject classifications, *b.* drawing and/or part number sequences, *c.* types and kinds of parts, components, assemblies, such as, standard (preferred) fasteners, bearings, resistors, etc., *d.* materials, platings & finishes, *e.* top-down breakdown of parts in assemblies, and *f.* manufacturers and contractors or vendors.
8. Customer service using aperture cards is faster, as retrieving and refiling originals is less time-consuming.
9. Economical (diazo duplicate) drawing copies in aperture card form, with the aid of viewers, provide ready reference for one time (throw-away) or permanent personal files of designers and draftsmen.
10. Coded and punched tabulating and aperture cards are useful for many data processing manipulations, and for studies, listings, analyses, reports, etc.

The flexibility of tabulating and aperture cards for recording engineering data, already encoded for interpretation in EAM equipment, provides the potentiality of converting that data to electronic data processing (EDP) equipment employing tape storage. The future innovation of rapid transmission methods, involving closed-circuit television with video tape storage and facsimile reproduction networks, also will enable interchangeable use of card formats.

"Micromation"

Perhaps it would be appropriate to coin a new word that more aptly describes the new processes associated with data automation and microreproduction. If so, the word "micromation" is offered to define those documentation systems utilizing miniaturized forms of data that are processed automatically.

Just as complex weapons are here to stay, so also are quite different engineering data requirements. A missile system, to illustrate, includes in its make-up all kinds of components manufactured by many diverse industries. Integrating these components into a weapons system involves a number of military services plus thousands of contractors. Lacking systematized engineering data, widely available, duplicate designs are unavoidable.

The ability to search and make use of appropriate recorded data depends on developing vastly improved methods for its storage, retrieval, reproduction, and distribution. Without convenient and rapid access to this data from previous research, progress is impeded.

Thus, the Department of Defense has come only part way in solving the many problems of automating engineering data for the instant use of its numerous activities. The "micromaton" field is relatively new, and rapid advances are appearing daily in materials, in equipments, and in techniques. With this realization, the Standardization, Armed Forces Supply Support Center, in July 1959 converted the original study into a permanent area assignment. Responsibility was delegated to the Department of the Air Force for continued development and maintenance of the "Department of Defense Data Microreproduction System (EDMS)."

The Military Departments have developed a Standardization Plan for this area, covering a three-year budgeting period. This plan schedules all work undertaken in the area, including the following projects in addition to those previously mentioned:

(1) Use of microfilmed engineering documentation records in lieu of originals
(2) Handbook on microreproduction of engineering data (for draftsmen)
(3) Microfilm equipments, review and standardization (includes viewers, mounters, printers, EAM – modified interpreters, sorters, collators, etc.)

Additional auxiliary projects are underway (Federal Supply Class 6750) for development of the following microfilm specifications:

Proposed Interim Federal Specifications

(1) Film, Photographic, Microfilm (Black and White)
(2) Film, Diazotype, Microfilm
(3) Film, Heat Processed, Microfilm (Kalfax Type)

System Factors

Drawings constitute one of the most important bodies of recorded knowledge in the world today. Without drawings, no products of any complexity could be designed or built. As unitized packets of data, they should have a uniformity of size and format to present a standardized set of instructions.

Standardization efforts in recent years have reduced those variables to manageable proportions. Both government and industry have a problem, however, in maintaining active files for about 400 different drawing sizes produced before standardization eliminated most of the huge variety. All those sizes must be handled and reproduced for the next twenty years or more. The reduction ratios chosen by the Armed Forces for microfilming considered this factor.

The ratios established by Military Specification MIL-M-9868 are considered to cause fewer operating difficulties when non-standard size drawings and new drawings are intermixed for microfilming. The image resolution factor is the most critical at the greatest reduction ratio. For example, when 120 lines per millimeter are specified for 30 diameters reduction, 100 lines can be specified for 24 diameters reduction to produce equivalent results. Likewise, 80 lines at 16 diameters is comparable to 120 lines at 30 diameters.

The number of generations employed for reproducing prints determines the degree of image resolution that must be specified for processed camera microfilm. The resolution requirement in Military Specification MIL-M-9868 is based on the cumulative image degradation caused by each successive removal from the first generation. The resolution loss between each generation on silver to silver films is 20 per cent, and on diazo to diazo films is 5 to 9 per cent. For industrial users who require no more than two generations, a lower resolution than the military specifies can be established to obtain quality prints. In standardizing for the Armed Forces, however, it was necessary to meet resolution requirements for the maximum conditions of users, or the fourth generation.

Impact on Drafting Rooms

Changing over from conventional methods of reproducing drawings to microreproduction systems has considerable impact on drafting rooms. Draftsmen had more leeway in the past as full-size prints made from first or second generation reproducibles involved no reduction or enlarging, just contact printing.

Processing engineering drawings from microfilm demands precision methods for satisfactory results. Printing-back involves more steps and more generations than blueprinting. The varying media used for both the originals and for the prints affect the final quality of line rendition.

The draftsmen has become an integral part of a microreproduction system. His skill in executing the original drawing represents a governing factor. He, therefore, must work to tighter drafting standards in producing consistent quality in the legibility of the reduced size prints made from microfilm. This means that drafting techniques require tailoring so they will mesh properly with system requirements.

Prior to modern microreproduction systems, drawings were reproduced from originals usually as full-size prints. Many drawings prepared today continue to meet only that requirement. The likelihood exists that reduced size prints will sometimes be unsatisfactory when reproduced from such originals by xerographic or electrostatic methods. Lines, figures, symbols, and letters may merge together to become unintelligible, or to cause errors in interpretation.

A current military study of the factors controlling legibility will disclose where Military Standards for drafting practices need revision to satisfy the microreproduction system requirements. A joint task group of the American Standards Association PH5 and Y14 Sectional Committees also plans a review of American drafting standards for the same purpose.

Concluding Observations

The Armed Forces look to industry for the future development of improved microreproduction processes with more contrast and density latitudes than are available with present films and equipments. Tolerances now must be kept small in every step, from the original drawing (line density versus background density), film densities (base and backing), image resolution, etc., through the final printing operations. The tighter the tolerance for each operation in a total system, the more exact must be the controls, all adding up to increased expense. An equally important consideration: when tolerances are set tighter than necessary production penalties are paid, this forces materials and equipments to operate marginally, causing higher rejection rates.

Today's 12-billion dollar research and development industry will grow into a 22-billion dollar giant in the next ten years, according to predictions. The Government represents 60 per cent of that research dollar, with the Armed Forces consuming the lion's share. This means, the problems faced today by both the Department of Defense and by industry, will double in magnitude in a very few years. Therefore, date management systems developed to meet current demands constitute but mere prototypes. The necessity for systematized engineering data, in terms of time, volume and uses will become more urgent in the near future.

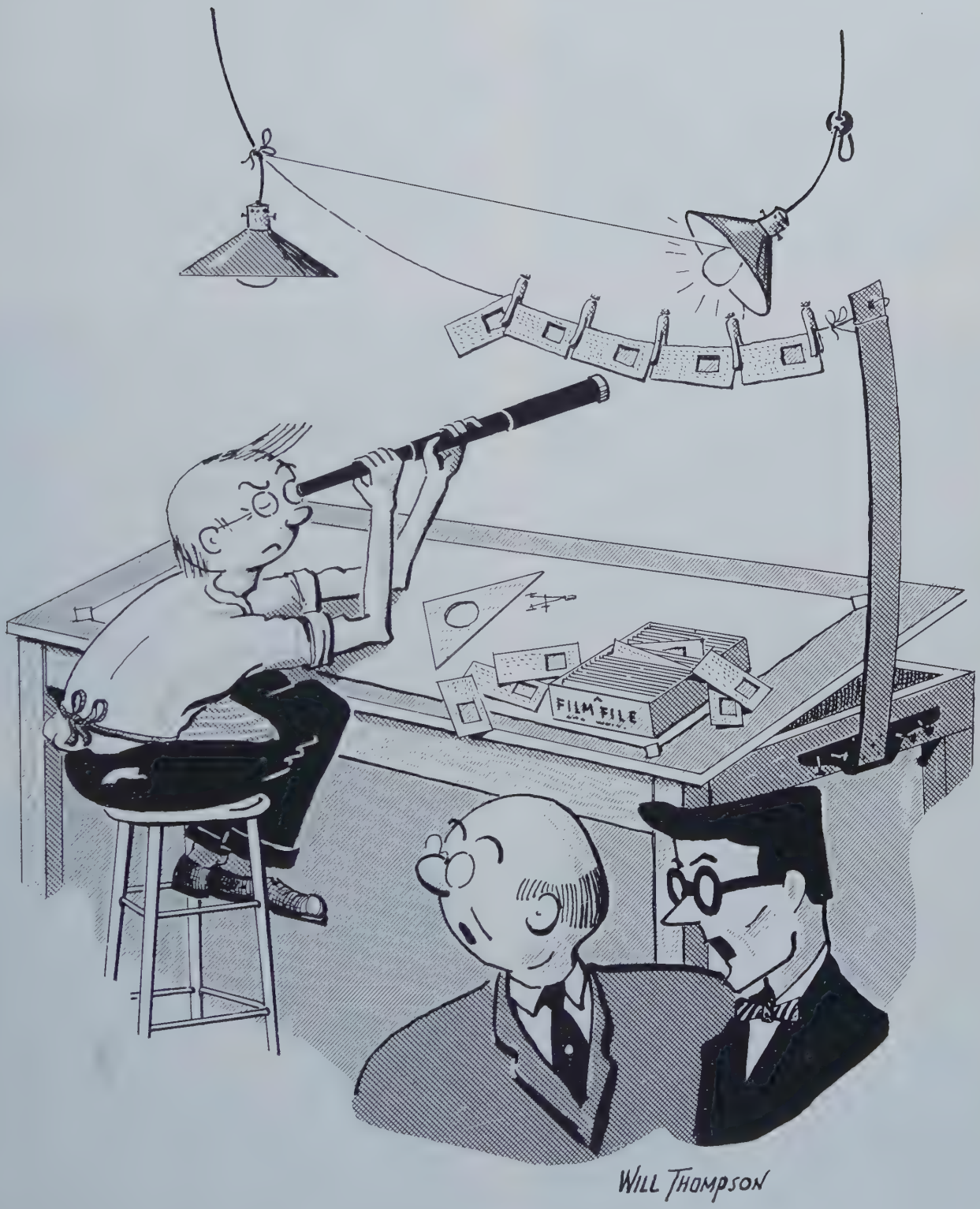
A future sophistication of the Department of Defense Engineering Data Microreproduction System conceivably will incorporate the entry of tape recorded data; from that data, aperture card sets will be reproduced automatically in any desired volume and data sequence.

One final prediction—before long the designer or the draftsman will be able to dial a number at his drafting table to select, view, and reproduce any drawing chosen from thousands, all in the space of a few seconds.

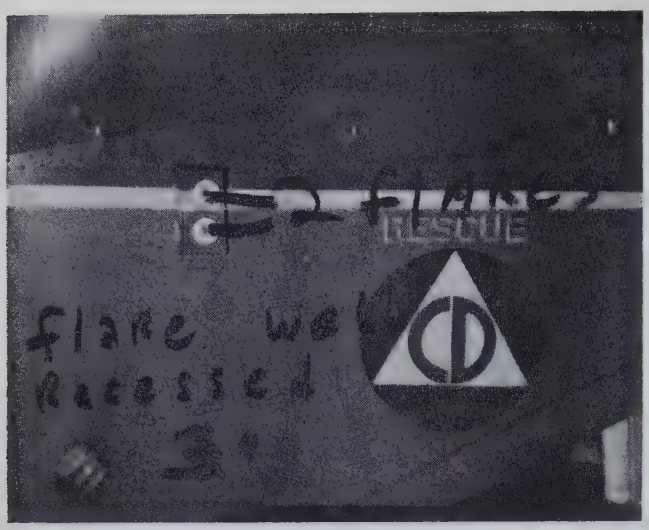
The Author

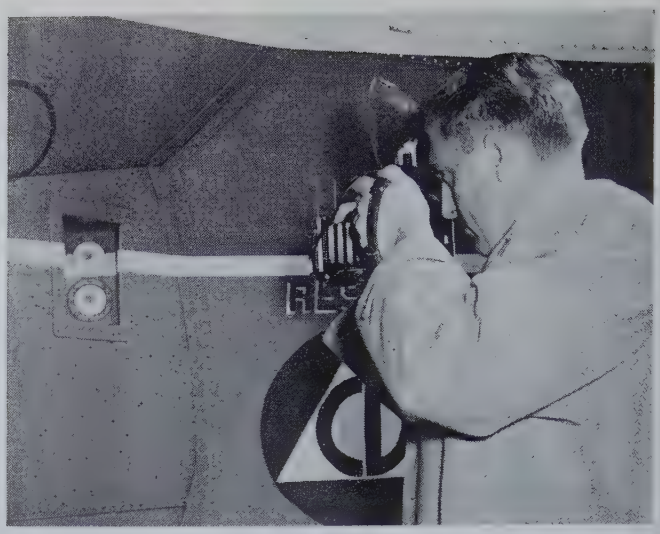
William S. Hutchinson is Assistant Chief, Mechanical and Engineering Programs Branch, Standardization Division, Armed Forces Supply Support Center.

Smudge

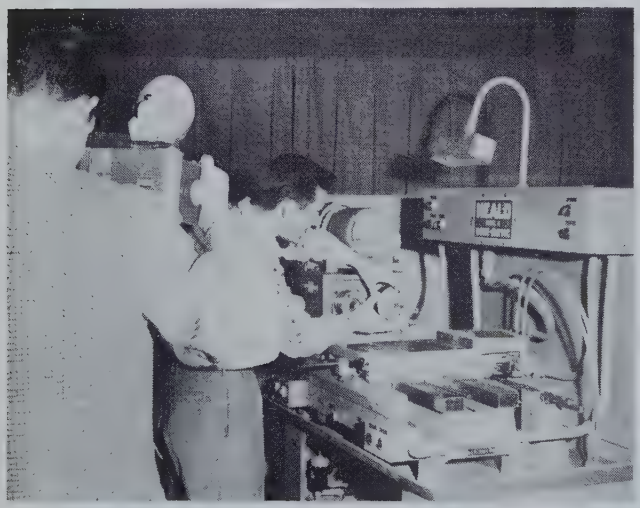


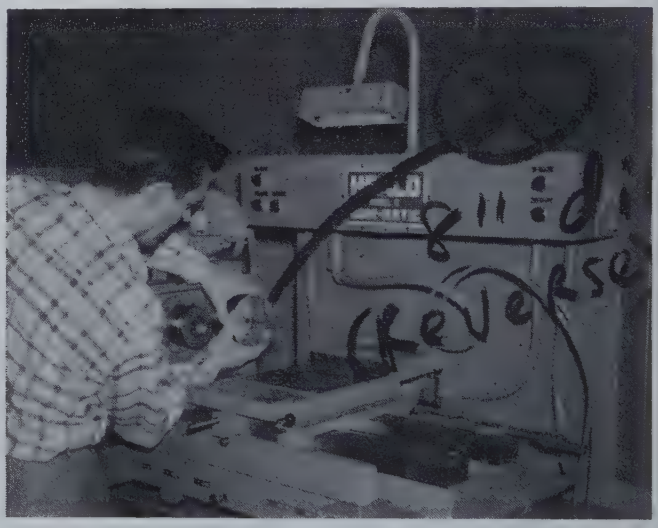
"Well, you may think he's hinting for a new reader. I say he's nearsighted!"





ACTUAL 60-second picture (above left) taken by Martin Schnabel, supervisor of passenger services for New York Airways (right), to show helicopter emergency flare system. Note details written on print with grease pencil.





TECHNICIAN at Herald Machine Co., Worcester, Mass., photographs a new grinding machine while workman adjusts part; actual picture (above right) calls attention to change. Prints aid company engineers in studying revisions.

MAINTENANCE foreman at Eitel-McCullough Inc., San Bruno, Calif., (manufacturer of electronic tubes), photographs milling machine which must be disconnected and moved to a new location. Picture is used to aid maintenance men in reconnecting machine; later, prints are turned over to the plant engineering department where they are filed.

On-the-spot Photodrawings

Development of prototype designs, revision of ancient drawings to conform with "as is" data, engineering maintenance and classroom instruction benefit from "60-second" photographic techniques

by J. H. Smith

ENGINEERS and draftsmen at many companies throughout the nation are using on-the-spot photography to convey to workmen—in less time than ever before—detailed information concerning size, position, identification and spatial relations on projects involving the installation, maintenance, or relocation of plant equipment and operating systems.

As with conventional photodrawings—the combination of photographs and descriptive data in place of engineering drawings—the use of 60-second pictures saves engineers and draftsmen hundreds of man-hours that were formerly required for the preparation of drawings. They provide workmen with a graphic illustration of the work area and job to be done, rather than a "symbolic representation" requiring "translation" by highly-competent technicians.

Camera Is Fast, Simple to Use

THE MAIN advantage of a photodrawing, of course, is the speed and simplicity with which it is prepared—and this is never more true than when the engineers are using 60-second cameras.

One-minute after shooting a picture with this camera, the engineer lifts the finished print out of the camera's back door. Before leaving the scene, he can jot down important measurements on the back of the prints and draw the proposed changes and modifications right over the photographic image.

This eliminates the need for tedious note-taking, and when he returns to his office after researching a reconstruction or relocation job, the engineer has a series of detailed photographs showing the existing facility in perspective—not a batch of unprocessed film, or two-dimensional pencil sketches.

When identical pictures are needed for distribution to several departments or work crews, they can be made on the spot in the engineer's office with a print copier—a compact unit about the size of a portable radio, which makes duplicate prints in one minute.

The camera's ability to produce a picture in 60 seconds offers the engineer one more important advantage: it teaches him how to take pictures! Most engineers are strictly amateur photographers, and if forced to rely upon conventional cameras for their picture-taking activities, they "burn up" a lot of film taking pictures which are incorrectly exposed, or which don't fully "describe" the subject matter.

However, when a camera produces each photo on the spot, the engineer knows before he leaves the scene if his pictures are clear, sharp, well-lighted records of the existing facility.

Perhaps the best way to examine the advantages of 60-second photography in the field of photodrafting is to take a closer look at how a few companies are combining "instant" photos and dimensional data to spare engineers and draftsmen hours of drawing time—yet provide workmen with an accurate and easily understood picture of the job to be done.

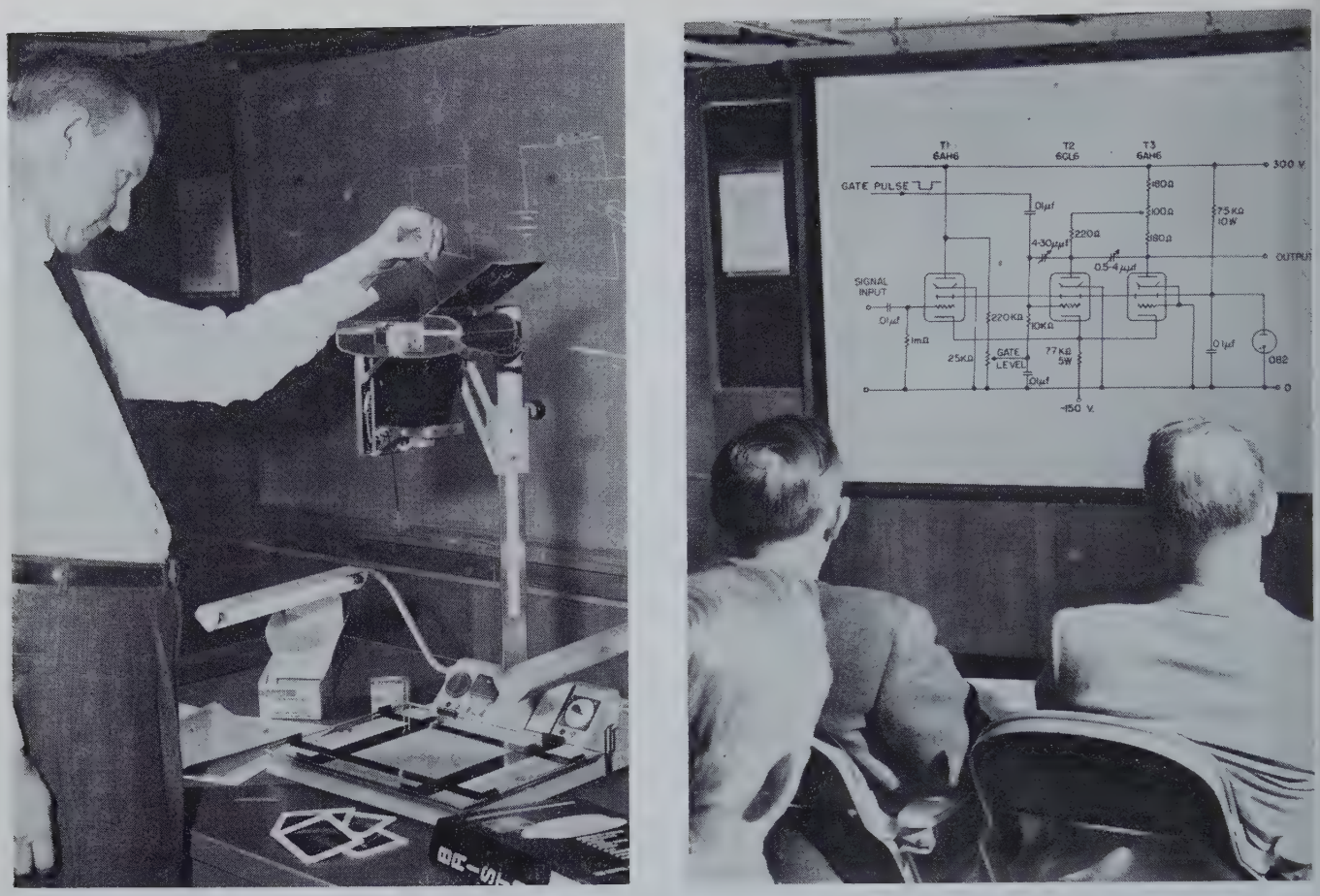
Photodrawings for Design Engineering and Installations

ONE OF THE widest applications for the 60-second photodrawings is in the area of design engineering and equipment installations.

For example, just before New York Airways was granted permission by the Civil Aeronautics Board to fly scheduled helicopter passenger runs at night, its 40-man maintenance department designed an emergency flare system and installed it in the tail section of all the firm's aircraft.

After more than 18 months of on-the-job trials, the miantenance men made a full sequence of 60-second pictures showing the design, installation and operation of the flare system. Pertinent details were written in grease pencil on the front of each

Editor's Note: All references to "on-the-spot" photography, "60-second" cameras, photos, slides, print copies, etc., are to photographic techniques and equipment developed and produced by Polaroid Corp., Cambridge 39, Mass.



EDUCATION department manager Charles Johnson removes a slide from back of camera two minutes after photographing "schematic" of measuring instrument for use in the Bristol Company's extensive training school for maintenance men at Waterbury, Conn. The instant slides are used as a supplement to individual benchwork in the classrooms.

print, and copies of the photos were mailed to two other helicopter airlines and several helicopter manufacturers, with a letter suggesting that the system become standard equipment on all rotary wing aircraft.

NYA's maintenance men did the same thing on another occasion when they installed a carburetor heating unit on all of the line's 12-passenger helicopters to overcome a "freezing" tendency in the engines caused by a lack of warm-enough air in the carburetor at high altitudes.

At the Herald Machine Company, a leading manufacturer of precision grinding machines in Worcester, Mass., research and development technicians often photograph a prototype unit that incorporates a new concept in machine engineering. Details concerning the machine and its various parts are sketched onto the 60-second prints, which are distributed to company engineers as an aid in studying revisions and modifications. The pictures are later filed with "spec" sheets for future reference.

The first time engineers at the Montgomery Engineering Company, Jersey City, N. J., used 60-second photodrawings was when their attempts to design an air-conditioning duct for an existing building was stymied because of a multitude of overhead pipes, lights and sprinklers. They had sketched and re-sketched the area, but couldn't come up with an accurate picture of the proposed installation.

Then that word "picture" struck engineer Edward L. Kessler. He photographed the installation area. The engineers sketched the new duct system right on the 60-second prints, noted all measurements on the back of each picture, and turned the photos over to the firm's draftsmen who prepared the final drawings.

The duct was designed and installed without a hitch — and Montgomery Engineering has been using "instant" photodrawings ever since.

But once a piece of machinery or conduit, etc., is designed and manufactured, it has to be installed—and here, again, many firms are relying on 60-second pictures to save engineers and draftsmen hours of sketching time, to obtain accurate bids from outside contractors, and to provide workmen with a detailed description of how the job should be handled.

For example, when the Premier Electrical Construction Company, Chicago, Ill., was engaged to increase the electrical service of a 17-story, 276-apartment building, the firm's engineers used a 60-second camera to photograph existing meter centers, stair landings and open shaft spaces, corridor facilities, kitchen arrangements and other areas pertinent to the system installation. Relevant measurements were noted on the prints.

Copies of the one-minute pictures were supplied to all contractors for bidding purposes, and later on were used by the prime contractor, mechanics, engineers, and building managers to keep abreast of what was going where and why. The photos eliminated all on-the-job confusion and resultant delays, and the installa-

(*Continued on page* 27)

A REPORT ON THE ADVANTAGES OF USING MYLAR® DRAFTING FILM

Engineering firm saves $50,000 by adopting new drafting technique

Now drawings are tear-proof, smudge-proof, easy to change, and completely washable. Sharp, clean reproduction assured.

Original drawings that are practically indestructible, and from which fingermarks, stains, and grime can safely be removed before printing, are not a brand new development. They have been taking hold among top companies in a variety of industries over a period of several years.

What *is* new are the reports many of these avant-garde firms are now making, describing actual results-in-use with this revolutionary method. The reports indicate spectacular success.

Before adopting this method, one leading firm spent approximately $50,000 a year in re-draws alone to assure clean, sharp reproduction. Now, because the original tracings never tear or smear, and because soil and stains can easily be washed off the original drawing before printing, this firm gets superior prints no matter how much the original drawing has been handled and soiled. And there is no longer any need for costly re-drawing.

Similar success after changing to the new drafting technique has been reported by many other leading firms in various industries where drafting room procedure is regularly reviewed and updated. While exact dollar and man-hour savings are not always available, they have been extremely impressive and have caused engineering management everywhere to sit up and take notice.

The most frequently reported comment has been on the excellent print quality which now can be maintained consistently regardless of how often the original is reproduced. The consensus among supervising engineers and chief draftsmen is that the new method results in prints far superior to those obtainable from tracing paper or cloth.

Started with drafting film

The new drafting method originated several years ago with the development of duPont Mylar®, a completely waterproof base material. Once the proper matte surface was formulated for Mylar, a remarkable new tracing material—called "drafting film"—was born.

There remained only one important problem: graphite pencil lines were neither smudge-proof nor waterproof on drafting film. Only with the creation of a special type of pencil that could produce a line that would not smear or be washed away could the full benefit of drafting film be realized.

A special type of pencil

The answer came from engineers at J. S. Staedtler in Nurnberg, West Germany, makers of the famous Mars-Lumograph drafting pencils and leads, who developed a new pencil specifically for drafting on film. Called Duralar, its lead is made of plastic rather than graphite. Duralar lines will not smudge, are easily erasable, and are absolutely unaffected by soap and water. When the drafting film becomes soiled, dirt and stains can be washed away—leaving the Duralar lines sharp and clear.

® T.M. FOR duPONT'S POLYESTER FILM

Why many top engineering departments are changing over to the new Mylar-Duralar drafting technique

There is good reason for the rapidly increasing use of drafting film and Duralar in preference to tracing cloth or tracing vellum.

Never before have engineers and draftsmen been able to work up drawings on such a tough, durable, versatile material and get such superior prints. Moreover, when drafting film is used, drawings are made only once—directly on the film.

According to chief draftsmen and supervising engineers in a cross-section of industries, the most startling and significant advantages of drafting film are those described below.

Practically indestructible

Mylar-Duralar tracings never tear or become dog-eared. They stand up to constant handling, printing *and* re-printing—will not crack, split, shred, wrinkle or wilt. Non-absorbent and waterproof—stains wash right off. Chemically inert—drafting film is unaffected by heat or age.

Good tracing line without pressure

There is no need to bear down to achieve clear, dense lines. Drafting film gives an opaque, well-defined line with smudge-proof, waterproof Duralar pencils (and with ink or typewriter). A complete range of five degrees of Duralar assures complete flexibility.

Easy to erase and make changes

The proper erasing techniques for Duralar, ink or typewriter make it a simple matter to revise on drafting film. Specially designed Duralar erasers sweep away Duralar lines easily, completely—without staining or marring the matte surface. (Good erasure quality can also be obtained for ink and typed work with the particular erasers recommended for each brand of film.) Note: electric erasing machines are not recommended for use on drafting film.

Can be washed before printing

Now many firms routinely "wash" each Mylar-Duralar tracing before microfilming or obtaining blueprints or white prints. Background soil, perspiration or fingermark stains—even stains from spilled coffee, soft drinks and other liquids—are easily wiped away with a soapy cloth or sponge, or with just a damp cloth. Result: clean, sharp contrast on all reproductions.

Superior reproduction

The clarity of prints is consistently exceptional. The durability of the original drawing, and the fact that soil and printing stains can be washed off between printings, assure far better reproduction than it is possible to get with conventional drafting methods.

Transparency to suit

Drafting film is made in a variety of thicknesses and surface finishes and selection should be made according to need. Thicknesses range from .002″ to .0075″. Films are available with matte surface coated on either one or both sides. Drafting film is generally considered to be the only really practical material for non-dimensional work such as lofting. The high degree of transparency of certain films yields excellent results in overlay work.

Strong but flexible

Though tough and strong, drafting film is not rigid. It rolls easily, lies flat, will not curl up, crumple or wrinkle.

Dimensionally stable

Drafting film has more dimensional stability than either paper or cloth. The .005″, .007″, and .0075″ gauges are especially recommended for non-dimensional drawings and projection enlargements.

Permanent

The proven durability of Mylar-Duralar tracings safeguards the investment in original drawings. Accelerated aging tests show that the film does not stiffen, crack, mildew or discolor with age. Tough and strong, it is not damaged by repeated handling and printing, and can be used and re-used indefinitely.

Not expensive

Drafting film is comparable in cost to tracing cloth (and it eliminates any need for costly re-draws).

Wide selection to choose from

Detailed ordering information for the Mylar-Duralar drafting technique is given on back cover.

Tests you can make—The features of the new Mylar-Duralar drafting technique are readily appreciated when you test them yourself. For example:

1 Wash Test—Using sample of film, draw a line with a graphite pencil and a line with a Duralar pencil. Rub a wet, soapy cloth over both. Only the Duralar line will remain.

2 The Smudge Test—Draw a graphite pencil line and a Duralar line. Rub your finger over each. The Duralar line will not smudge.

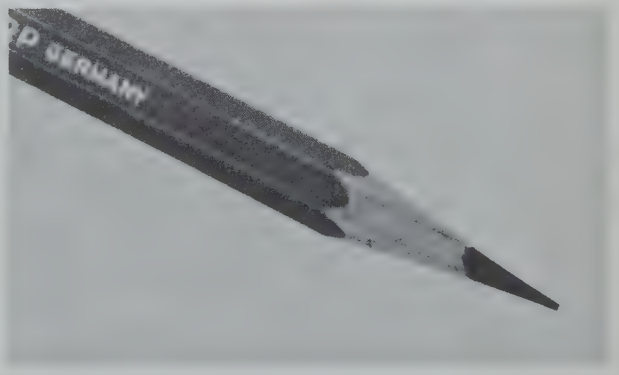
Soiled tracings pose no problem now

The Wash-and-Print System Assures Clean, Clear Reproduction Every Time

Even old, badly stained Mylar-Duralar tracings can be washed clean as new. Above—general soil, fingermarks, beverage stains, and printing stains from the last time this drawing was reproduced are being wiped off with a soapy sponge. The sharp, clean contrast visible where soil has been removed is the secret of sharp, clean prints.

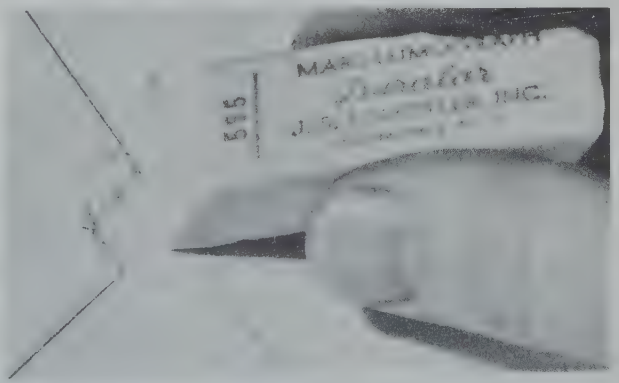
Correct technique for drafting with Duralar on film

The Mylar-Duralar drafting method is easily incorporated into drafting room procedure if it is recognized from the start as a new technique with a few special tricks of its own. Encouraged to practice and perfect them during the "breaking-in" period, draftsmen soon find them second-nature. (Experience shows it normally takes a draftsman about three full drawings—from then on he's a convert to the new method.)



Use a rounded point and rotate the pencil while drawing a line. Use a sandpaper block for the final touches to the point, but avoid a needle-sharp point. Rather, blunt the end slightly, on the sandpaper, after sharpening.

Decide which of the five Duralar degrees work best on the particular film you are using. See next page for a list comparing Duralar degrees to standard graphite degrees.



Best erasures are obtained with the specially developed Duralar erasers which do not stain or mar the matte surface. (Electric erasing machines are not recommended.)

You can choose from a wide selection of drafting films

and specially developed Duralar products

DRAFTING FILM

All leading drafting and engineering suppliers carry drafting film. There are many different brands all of which are available in a variety of surface finishes, thicknesses and sizes—but all brands have a completely waterproof Mylar® polyester film base.

Surface Finish—Available with matte surface on one or both sides. Also with special scribe or strip coatings.

Thickness—Made in six gauges: .002″ .003″ .004″ .005″ .007″ .0075″.

Size—Available in a wide range of sheet and roll sizes.

Color—Made in clear or tinted form.

MARS-LUMOGRAPH DURALAR PRODUCTS
developed specifically for drafting film

Duralar products are available everywhere drafting film is sold.
Dealers welcome inquiries and are glad to supply samples for testing purposes.

The following products were specially developed for making smudge-proof, waterproof tracings on film:

2830 Duralar Drawing Pencils*
1905 Duralar Drawing Leads*
1016 Duralar Lead Holders
555 Duralar Erasers

*Duralar pencils and leads are available in five degrees
K 1 – equivalent to B
K 2 – equivalent to F
K 3 – equivalent to 2 H
K 4 – equivalent to 4 H
K 5 – equivalent to 6 H

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LITHO IN U.S.

(*Continued from page* 22)

tion proceeded smoothly and on schedule.

Another firm which uses a 60-second camera for estimating purposes is the Plaunt Plumbing & Heating Company, Duluth, Minn.

When attempting to bid on a commercial modernization job, owner James Plaunt uses his 60-second camera to photograph the existing layout. In addition to noting the necessary measurements on the prints with a grease pencil, Plaunt also carries a portable tape recorder so that he can dictate more detailed specifics concerning each picture.

Once he returns to the office, Plaunt sits down with his estimators and plots the new layout with the aid of the pictures and notes he has taken; he submits a bid on the basis of these findings.

60-Second Photodrawings For Maintenance

Another area where photodrawings made with 60-second prints are widely used is in the field of maintenance. Getting each picture on the spot, engineers are able to photograph an existing machine, piping or wiring system, etc., sketch the required changes and modifications on the prints before they leave the scene, and hand the photos to a maintenance supervisor or area foreman with a work sheet giving him specific instructions about the work to be done.

How effective is this technique?

Let's take a look at how maintenance engineers at Monsanto Chemical Company's Springfield, Mass., plant proved to "skeptics" in other Monsanto plants throughout the country that one-minute photos attached to work instruction sheets resulted in greater efficiency and economy on plant maintenance projects.

The maintenance engineers assigned two work crews to identical jobs—a difficult duct relocation—in separate buildings. One group was provided with a series of 60-second photographs showing the existing facility with the proposed installation sketched over it. The other group had to work from detailed written descriptions only.

The result: the crew aided by the one-minute photos completed their job in half the time required by the second group.

Another large petrochemical manufacturer that prepares photodrawings with 60-second pictures as part of its maintenance planning program is the Dow Chemical Company, Pittsburg, California.

The details of how each major (requiring more than two man-hours) maintenance project is to be handled are filed in a special work order packet which is supplied to the area foreman. Included in the packet are several 60-second pictures which locate the area or equipment needing maintenance.

By sketching on the prints with a felt-tipped pen, engineers are able to produce a simple, clear, isometric-type description of the piping or equipment alteration to be made—and they save themselves and the company's draftsmen hours of sketching time that would normally be required to produce engineering drawings.

Two-Minute Slides Aid Draftsmen

While most firms that are using 60-second cameras to prepare their photodrawings snap 60-second paper prints, a few companies are putting a transparency system to work as an aid to their draftsmen and engineers.

This slide system is based on a picture roll (projection film) which produces a black-and-white positive transparency in two minutes. The slides may be projected as soon as they are lifted out of the camera's back door. The film has eight exposures to a roll, and the slides may be either of two sizes — 2¼-inches-square for use in a projector, or 3¼ by 4-inches for use in standard lantern-slide projectors—depending upon the film type used.

A good example of how the two-minute slides can be worked into a firm's training program to assist draftsmen and engineers in explaining the operation of complicated machinery and electrical systems to maintenance men may be drawn from the Bristol Company, Waterbury, Conn.

Instructors at Bristol's extensive training school are using a 60-second camera mounted on a copymaker—a compact unit with built-in lights, which is used to photograph anything that fits onto its 11 by 14-inch easel —to shoot slides of line drawings, graphs and schematics prepared by the engineering and drafting departments.

Projected during training classes, these slides are used to supplement individual benchwork in teaching the firm's maintenance men how to operate and repair automatic controlling, telemetering, and measuring instruments.

The instant slides may also be combined with written material typed onto sepia intermediate paper and fed into a diazo (ammonia process) machine to produce economical, illustrated reports.

One company that is using this technique is Trans-Sonics Incorporated, Burlington, Mass., a leading manufacturer of precision transducers. Slides illustrating the operation of the company's products are taped onto acetate sheets and reproduced in the firm's diazo machine with printed material that has been typed onto sepia intermediate paper.

The illustrated test qualification and operation sheets are distributed to the firm's engineers and draftsmen as an aid in studying product modifications, improving the unit's operation efficiency, etc.

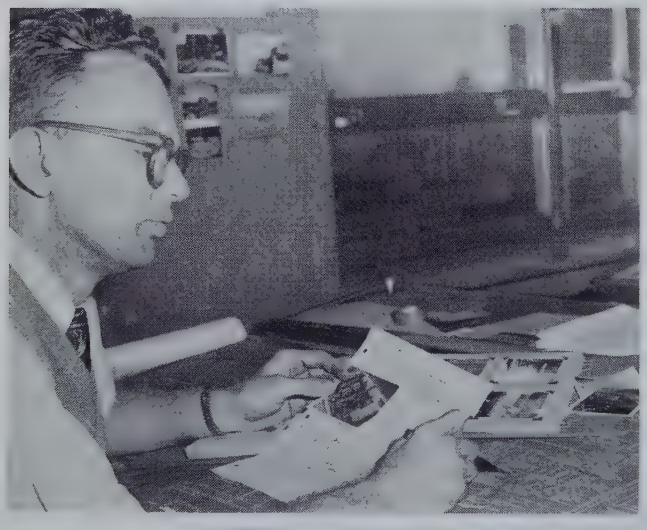
Draftsmen Use Prints To Up-Date Drawings

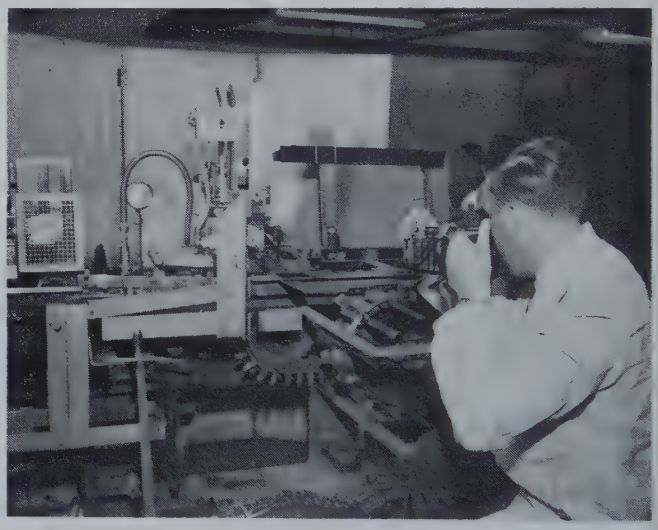
The use of 60-second photography by draftsmen and engineers isn't limited to the area of photodrawings, where the one-minute prints are combined with dimensional data and used in place of engineering drawings or blueprints. Engineers at many firms are supplying draftsmen with 60-second prints of existing facilities in order to help them up-date "as built" drawings that were prepared decades ago.

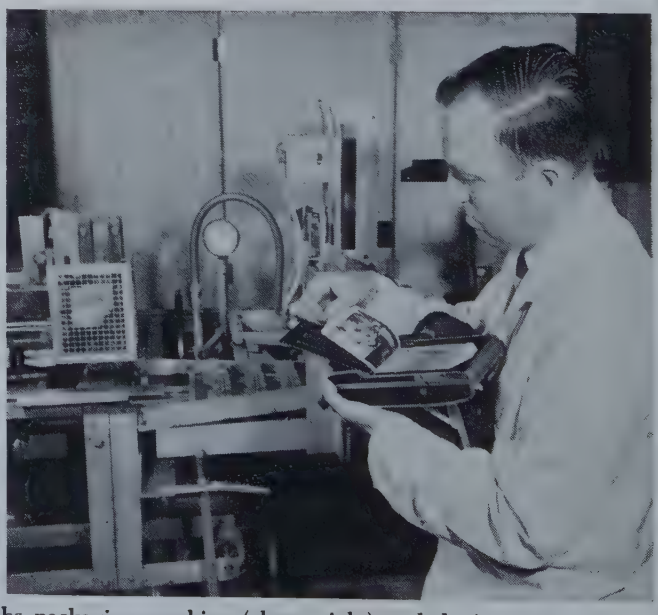
One of the largest users of this technique is the New York City Transit Authority, which operates the bus and subway systems in the five Boroughs comprising the City of New York. To keep these systems performing at peak efficiency, the NYCTA is constantly making plans for the building and renovation of tracks, garages, terminals, rolling stock, shops and signal, power, lighting and other electro-pneumatic equipment.

Most of these projects are handled on a "lowest bid" basis, and to obtain accurate bids, NYCTA has to supply contractors with blueprints that show the proposed changes. In preparing new drawings, the firm's draftsmen have to work from "as built" drawings

ELECTRICAL engineer Sol Rolnick of the New York City Transit Authority, lifts finished print from back of 60-second camera while researching renovation project at subway terminal. Draftsman at lower left uses photo to up-date 30-year-old drawing. Print taken by Rolnick is shown above.







DRAFTSMAN for Lever Bros., Cambridge, Mass., photographs packaging machine (above right) to help in revising drawings dealing with heat-sealing unit. One minute after snapping the shutter, he has the finished print (lower right). At left, he is shown working on drawing with photograph as a guide to the engineer's report concerning alterations.

made 20 - to - 50 years before—and rarely kept up to date.

The firm has equipped its electrical engineers with three 60-second cameras so they can shoot pictures at the job site and turn them over to draftsmen with pertinent information concerning the proposed change.

The first year the NYCTA used the instant photos, the firm's engineers saved hundreds of man - hours over their former pencil-sketch method of researching the job sites.

In fact, the 60-second technique has proved so successful the company maintains a special photo album on every station in its vast network. Each album is a complete pictorial "master plan" of that station.

Savings In Man-Hours Drops Actual Cost-Per-Picture

What about cost? A Polaroid Land print costs about 27 cents, not including a flashbulb.[1] A Polaroid slide costs 55 cents, including the snap-together plastic mount.

Although these material costs are comparable to those for pictures taken with conventional films and cameras (see Graphic Science, November 1959, page 20), the over-all cost of a Polaroid shot is less because the Land Camera eliminates the need for expensive film processing man-hours and darkroom work.

Where the user can see each picture a minute after taking it, however, there is no need to "bracket" pictures by shooting the same scene at three or four different exposures to make sure at least one comes out right. If the engineer's first print isn't correct, he can make a quick adjustment and shoot the scene a second time. By getting each picture as he takes it, the engineer doesn't have to worry about wasting half a roll of film to get three or four pictures developed in a hurry.

[1]Flashbulbs are not necessary if Polaroid's new 3000-speed film is used because the film is fast enough to take pictures indoors in situations where the lighting conditions are inadequate for regular speed films.

The Author

J. H. Smith is applications engineer at Polaroid Corporation, Cambridge 39, Mass.

Operations and Procedures for Engineering and Drafting Supervisors

Appendix, Part I

A series of helpful checklists for the qualification, selection, training, and development of supervisors

by George C. Schmidt

MAXIMUM creative performance can be obtained from draftsmen, designers and engineers only when the supervisor understands and appreciates all the necessary ingredients of creative supervision. He is the key figure. His attitude can either stimulate or stifle potential creativity.

PERSONAL CHARACTERISTICS AND WORKING ATTITUDES FOR QUALIFICATION AS SUPERVISOR

THE FOLLOWING specific characteristics are listed to enable the supervisor to better understand what is expected of him. The supervisor should:

1. *Be creative.* He should be free from bias imposed by conformity. He should have active technical imagination of a high order, which should express itself in an ability to detect and offer creative challenge to his group. He should be able to generate ideas himself and to recognize the merits in a wide range of ideas.

2. *Understand the Creative Process.* He should have an articulate insight into the nature of the creative process. He should have confidence that the contributions of his subordinates cannot be predicted, and that creativity occurs in spurts. Rather than trying to limit the trials and frustrations of the process of creativity, the wise supervisor must try to understand this cycle, nurse the project along, and give the proper encouragement at the proper time. He should understand the basic psychological characteristics of creativity, some of the "blocks" which inhibit it, and some of the methods which can be used to release creative approaches in his subordinates.

3. *Understand Creative Temperaments.* He should learn to understand his subordinates' powers and weaknesses, their motives, their fears and their enthusiasms. Different individuals have different ways in which they feel their creative spirit to be released. Helping a man to get the best out of himself means helping him to find and release his particular way of operation. Much of what the supervisor sees in his people and how he evaluates them is related to his own self-concept, his own value system, his own defense mechanisms, etc. Unless he understands himself pretty well he is apt to "clobber" his men with his own prejudices.

4. *Have High Technical Competence.* He must be conversant with the scientific aims of his group. The supervisor should be a man who, while not necessarily as up-to-date in every detail of some of the activities as may be those whom he is supervising, has nevertheless the power to enter personally into the problem at any one point, and be of help to his people in the region of their several specialties, even though his people may be much more familiar with many of the details than is the supervisor. Unless the supervisor has this background of fundamental power, he is of very little use.

5. *Inspire and Encourage.* The supervisor should be a man who has contagious enthusiasm for research and study, who constantly encourages and stimulates his people to come up with new imaginative approaches, who welcomes innovation and change, and who takes a lively and active interest in their actions and problems. This active interest in the work underway, combined with a hands-off policy concerning its direction, is one of the most fruitful things that a competent supervisor can do, particularly with his younger personnel; but this is not an easy thing for the supervisor to do. He who keeps in touch with his subordinates' work finds it natural to impose his own ideas or, if he wants to give them a free hand, it is all too easy to leave them isolated. To achieve the proper balance between interest and isolation is a feat which requires a great deal of skill in human relationships.

6. *Safeguard Areas of Freedom.* He should define the ultimate design goal

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Editor's Note: The Appendix, Part One presented here is a continuation of George C. Schmidt's article, begun in the December issue of GRAPHIC SCIENCE. The article was based on a paper delivered by the author at the Engineering and Drafting Management Institute, held at the University of Wisconsin, Madison, Wis., October 8-9, 1959.

in a general way. He should indicate to his designers what is expected of them, what they are permitted to do, and the areas where they can exercise independent judgment and freedom. While engineering groups must have an awareness of objectives of time limits, designers should never be forced to work in an atmosphere of urgency which presses them to find immediate solutions to problems. There is plenty of evidence that "crash" programs have inhibited more creative ideas than they have produced and, too, such crash programs are costly in the end due to errors of omission and commission.

7. *Bolster His Men's Confidence.* The supervisor should bolster the confidence of his men to insure sustained effort. The supervisor can do this partially by instilling confidence in each individual's ability to come up with something good, partially by emphasis on the importance of the objective.

Since most people suffer from a feeling of inferiority, recognition of the fact that an individual has something to give goes a long way toward making him feel that he can do it. Therefore, a supervisor must indicate to his talented personnel that he expects each one of them to produce. This can be done in such a way that it is not anxiety-producing, but is instead ego-producing. Nothing can inhibit creativity more than critical judgment or evaluation applied prematurely in the process of developing ideas of design. Because such ideas often develop slowly the supervisor should resist any inclination toward discouragement. He should provide the members of his team with all the moral support at his command during such difficult development periods of the work.

8. *Respect Others' Ideas.* Too many supervisors fail to take the advice and suggestions of their subordinates because of an unconscious tendency to feel they alone should retain the power of supervision and decision. Yet it is in the nature of modern technology that some of his men should know more about certain things than he does.

The supervisor should be more "goal-oriented" than "status-oriented;" he should be more interested in seeing problems solved than in gaining the personal glory. He should be a humble man, humble about his particular area of knowledge and convinced that other specialists can contribute significantly to solving a problem. The supervisor should never dominate his group, even though he has to retain his group's technical respect. When he produces ideas, he should do it without showing off. He should be accepted by his men not so much as a leader, but as a colleague who is on a par with the members of his group in their team operations.

9. *Be a Tactful Critic.* The supervisor should be open-minded, receptive toward ideas and suggestions offered by his group. At all times he should be a good, understanding listener. If he must criticize, he should do so skilfully and tactfully. He should employ judgment diplomatically; evaluate tactfully; have a firm belief in the Golden Rule, and if an idea has to be turned down do it tactfully and in a way in which to give the employee some "ego-satisfaction." No matter how tough the worker may be, over-critical attitudes, cynicism, ridicule, or even plain in-

difference on the part of the supervisor is tremendously destructive of idea-producing ability.

10. *Service the Group's Needs.* He should be a selfless, confident and alert role-player, sincerely concerned with promoting the growth and development of each member of his group over and above the concern he may have of his own status and prestige. He should handle all the administrative work of his group, provide the necessary materials and facilities and protect his group from time-consuming "fire fighting" jobs, and other unreasonable demands and pressures from management. He should make the group feel that his main interest is in the people in his group.

11. *Be the Group's Spokesman.* He should have the ability to get along with management and have considerable influence with them while protecting his subordinates, otherwise the morale and enthusiasm of the supervisor's group tend to be low.

12. *Give Credit Fairly.* He should be able to convince members of his group that they will be properly identified with their part in the group's success.

13. *Assign Responsibility Skillfully.* The supervisor should know his people so well as individuals that he can make assignments that will conform to the personalities, interests and abilities of the individuals. This will require the knowledge of each individual's particular strengths and weaknesses, so that each is assigned a problem where his chances for contribution are the greatest.

14. *Control "Lightly."* Leave each creative worker either completely alone or exert minimum direct influence on him. Individual performance is slightly higher under an intermediate degree of dependence than under full dependence or full independence. Younger subordinates benefit somewhat more from "mutual influence" between the supervisor and themselves; older and more experienced subordinates benefit somewhat more from "separation." It seems plausible that too much independence may deprive the subordinate of the stimulation that a competent supervisor can provide. On the other hand, too close dependence on the supervisor may stifle individual initiative. By this line of reasoning, highest performance should result if we can combine the benefits of frequent stimulation with the assurance of freedom for initiative.

How to Pick Good Supervisors

It costs from $1,000 to $3,000 to hire (and lose) a man from outside for supervisory work. It costs at least as much to upgrade a man from the ranks—and many times more to pick the wrong man!

1. *Study Successful Supervisors.* What qualities do they have and use that should be looked for in selecting a supervisor or lead-man?

Good health — to do a full day's work every day.
Good appearance — clean, shaved, neat, orderly.
Good home life — a happy home makes a "happy" man.
Honesty, sobriety — personal integrity, good habits, reliability.
Ambition—sufficient "drive" to get ahead.
Intelligence—ability to learn his job and do it better.
Mechanical ability—to understand, maintain, and teach operation of equipment.
Personality—cheerful, likable, courteous.
Ability to handle people — tact, diplomacy, firmness.
Ability to plan and organize.
Judgment and decision.
Job knowledge — control of operations and costs.

Other qualities may be added to this list from personal observation.

2. *Study the Failures.* What qualities did they have that should be avoided in future supervisors?

Poor health.
Domestic difficulties.
Too much "education."
Doubtful honesty.
Insufficient job knowledge.
Inability to take responsibility.
Others?

3. *Plan* your interview before placement—use an outline and follow it!

4. *Try practical aptitude tests* of intelligence, mechanical ability.

5. *Sell* him the opportunities of the job. Develop interest at the start.

The Author

George C. Schmidt is Chief Draftsman, Campbell Soup Company, Camden, N. J.

USASESA Pioneers Use of Unitized Microfilm and Punch Cards for Efficient Engineering Communication

The U. S. Army Signal Equipment Support Agency (USASESA) at Fort Monmouth, N. J., prepares all procurement data—specifications, drawings, standards, etc.—used by industry to manufacture the highly complex material for which the Signal Corps is responsible. These requirements for procurement are distributed by USASESA to the U. S. Army Signal Supply Agency, the world-wide Signal Corps depots, all Signal Corps research and development activities, and the U. S. Air Force.

Within 1960, the centennial year of the U. S. Army Signal Corps, micro-reproduced engineering data for 220,000 Signal Corps drawings will be available at world-wide locations of the Signal Corps. In addition, most of these locations will also have a complete set of 400,000 manufacturers' drawings.

When USASESA started its planning in 1954, it was a pioneer. In fact, the military establishment started its operation before all equipment pieces were available. Today, some of USASESA's pioneering in converting full-sized originals and intermediates into aperture cards is accepted practice in both government and industry; the optical mounting of microfilm into Filmsort aperture cards is a case in point.

Less well known, however, are other innovations at USASESA. The military procurement agency was one of the first, for example, to use IBM equipment modified specifically for the Filmsort Military "D" aperture card. Today, USASESA makes some 5,000,000 passes of aperture cards through modified IBM reproducers, interpreters, and sorters.

Furthermore, USASESA has converted the master data card into a valuable by-product. For example, this data card served as a keystone to correlate master Signal Corps drawing lists for the respective Signal Corps equipment type numbers. In addition, the master data card has replaced a visible index card file which, by means of hands posting, formerly served as the historical record of revisions.

The new format of unitized microfilm and punch card has helped to cut the time lag between receipt and distribution of new and revised drawings, and between requisition and delivery of engineering data. Prior to the adoption of the new format, it took six weeks from date of release approval to actual data distribution; it now takes two weeks. Formerly, it took as long as three days to furnish a print at one of our service counters; it now takes less than 90 seconds to deliver a reference Duplicard for instant projection.

In short, USASESA started out to furnish miniaturized reproducibles in punch cards. Today it has begun to find uses for the punch cards, with and without apertures, to improve engineering communication.

This article was prepared with the technical assistance of Francis R. Borden, project engineer, Signal Corps Engineering Data Microfilming Project. Mr. Borden is a member of the steering committee for the Engineering Data Microreproduction System Project of the Department of Defense, currently formulating the standards to be used within the DOD for exchange of microfilmed engineering data.

Transformation of a File

It was in June of 1958 that USASESA began the transformation of its file of 22,000 Signal Corps drawings into 18 sets of aperture cards. Since that time, some 400,000 manufacturers' drawings have also been converted into 16 sets of aperture cards.

The conversion of these files represents 11-million aperture cards. To keep the engineering data files current, USASESA has to distribute 18 sets of 40,000 new and revised manufacturers' drawings.

The decision to change over from full-sized paper intermediates to microfilm mounted in aperture cards was based upon certain studies.

Savings in Weight

For example, our studies showed there were exceptional savings in making distribution of engineering data with aperture cards instead of full-sized intermediates. The savings in weight for distributing 1,000 drawings was 80 pounds for aperture cards as compared with originals or intermediates.

In our manufacturers' drawings, we saved 16 tons of weight with aperture cards for each set of 400,000 drawings. Total weight savings for 16 sets was 256 tons. To maintain the manufacturers' file of 15,000 revisions, there

was an additional savings of 9.6 tons annually. In the Signal Corps set of 220,000 drawings, the savings in weight with aperture cards reached 158.4 tons for 18 sets. The savings in weight on revisions for the 18 sets was 28.8 tons annually. This savings in weight brought about two additional savings. The first was a savings in the cost of distribution. The second was a savings in the time of distribution.

Savings in Space

Like weight savings, space savings have two additional advantages. The first is the area to house the data. The second is in the filing equipment for the data. For example, a Signal Corps field activity now needs but 15 standard file cabinets for aperture cards to hold 220,000 Signal Corps drawings, 400,000 manufacturers' drawings, plus the first year's increment of 55,000 new and revised drawings.

Full-sized intermediates would have required almost 500 special filing cabinets. The space savings is a 30-to-1 ratio. And this savings reflects itself in the actual filing operations.

Faster File Service

In file service, USASESA studies show that filing operations for aperture cards were more than three-and-a-half times faster than for full-sized paper intermediates. USASESA time required to locate, pull and refile 1,000 paper intermediates was 16⅔ hours. The same operation for aperture cards now requires 4⅝ hours.

Control of Data

The advantages of space savings and handling ease for the field activities are important. Most important is that each field activity now has a full set of controllable data. Information is shipped to them in file sequence order. With complete information, easily maintained, decentralization is now possible. Consequently, if desired, decentralization of procurement becomes feasible.

In addition, completed information provided to Signal Corps activities relieves the central disbursing point of handling routine and rush requisitions. Formerly, it was impossible to furnish, where necessary, complete sets of manufacturers' drawings. Consequently, there was a demand from the field, by requisitions, for sections of this file. In addition, not all locations had complete sets of Signal Corps drawings. As complete sets reach the field, central disbursing does not have to fill local requisitions. Now rush service becomes a true emergency.

The miniaturized reproducible is always under the file control of the field activity. For example, at USASESA a record is kept of the number of Duplicards made within a year. The average is 3,000 a month. In this instance, requests for 3,000 drawings were each satisfied within 90 seconds and at no time did the aperture card leave the file. In most cases, projection of the Duplicard in a viewer met the engineer's requirement.

Filing Sequence

At USASESA and in the field, the converted files of manufacturers' drawings are arranged in alphabetical and numerical sequence, by manufacturer, without regard to drawing size. To accomplish this objective, a set of 400,000 aperture cards had to be in an order entirely different from the filming and mounting sequence.

The job was complicated. Every manufacturer has his own system of numbering drawings. The drawing number is usually a combination of letters, symbols, and numbers. Such letters, symbols, and numbers can appear in almost any location in a pattern of 15 columns.

Normal sorting procedures for a set of 400,000 manufacturers' drawings would require four man-months. The actual job is being accomplished in one man-month.

This problem of sorting 400,000 cards into an alpha-numeric sequence by manufacturer was discussed with Recordak Corporation, a Signal Corps contractor, who suggested the present procedure that saves approximately 9,000,000 passes per set of cards.

The USASESA master data cards were created in film frame sequence. The sets of aperture cards, reproduced from the data cards, were in identical film frame sequence. Recordak recommended that the master data cards be sorted into the desired alpha-numeric sequence. Once this sequence was accomplished, each card was given an accession number for its location in the desired alpha-numeric sequence.

The accession number was six digits. The USASESA card had six adjacent blank columns. So the accession number was placed in columns 19, 22, 27, 30, 53 and 77. Furthermore, 9-zone punch and sorting had to be suppressed for columns 19, 22 and 27, since these were already punched in the 9-zone.

After this accession number process was completed, the master data cards were restored to film frame sequence. In this order, from the master data cards, the accession number was reproduced into the aperture cards and simultaneously compared with the master data cards. To reach alpha-numeric sequence by manufacturer, the aperture cards were given six passes through a modified 082 sorter. These six passes replaced a possible 30 sorts.

The Signal Corps, using two modified 082 sorters and two modified 514 reproducers, puts two sets of aperture cards through some 5,000,000 passes. Spoilage of film images in this operation, involving 400,000 aperture cards per set, is less than 1 per cent.

This punch card procedure for the conversion of full-sized intermediates into aperture cards makes possible the distribution of two sets of manufacturers' drawings — 800,000 aperture cards—each month. Each set is received by the field activity in the proper file order. Originally, it was estimated that the 16 manufacturers' sets would require seven years for distribution. The Recordak suggestion cut this estimate to an operation of 18 months.

Handling Procedures

As has already been said, USASESA was one of the first users of modified IBM equipment for aperture card techniques. This has permitted USASESA to mechanize the handling procedures for its engineering communications.

In USASESA procedures, new and revised drawings, grouped by size, are released to the contractor, the Recordak Corporation. The drawings are listed on a code sheet. Each line of the sheet represents both a film frame and a card. The code sheet is verified before the camera operation begins.

The drawings are filmed in listed sequence. While the film is being processed, a master data card is prepared

for each line of the list. The sets of aperture cards are reproduced for distribution from the master data cards. Film and aperture cards reach the optical mounter point where film and card data are verified prior to mounting.

Individual sets are sorted into alphanumerical file order. The master data card is used to tabulate shipping lists and all records of transmittal.

With this straightforward procedure, the Signal Corps provides engineering communication for some 6,000 items, of which between 1400 and 1600 are standard for military usage.

In the filming operation, two exposures are made for each frame. A positive intermediate is printed of the master camera film, and duplicate negative film is made from the intermediate. The sets are separated at the mounting point.

The making of film duplicates from master aperture cards is an integral part of the new engineering communications procedure. On facet of this procedure is quite familiar to most who are using microfilmed engineering drawings. It involves duplicating the microfilm in USASESA aperture cards onto diazotype blank film. With this technique, USASESA handles individual engineer's requests.

The advantage of this Duplicard procedure is file control. The aperture card file can always be used. There are no "out" cards; no cards waiting to be refiled.

The dry duplicate film has another advantage in that a file can be recreated for other uses. Thus, an area may receive a file, and dry-duplicate a portion of the file for point of use at the local activity.

Duplication from aperture cards provides the fastest method of recreating engineering data without disturbing the file of original drawings.

Provision for Spoilage

There is another facet of film duplication of interest to USASESA. Obviously, systems and procedures for use of aperture cards will result in some spoilage. At USASESA the intermediate positive film is mounted. A technique for using this mounted film to create additional silver-film negative copies is under study. With such a technique, lost or damaged cards can be filled from a master file.

At USASESA, optical printing on silver-film would provide a duplicate film copy consistent with the quality of the original file. If the duplicating technique were fast enough, it could also provide for expanded decentralization of the files.

Systems Improvement

In the experience of USASESA, an important factor in broadening the base of engineering communications is to provide simplicity in filing, retrieving and reproducing such data. Make engineering communications increasingly available and the next natural event is additional systems improvement.

Generally, such systems improvement will demand additional copies of aperture cards. Hence, the ability to create duplicate files of engineering data becomes increasingly important in attaining the full effectiveness of the overall system.

Today, a Signal Corps drawing filmed under Signal Corps auspices at USASESA finds its way into Air Force activities and procedures. In the future, there will be a much greater exchange of engineering data among the services. To make such exchanges

both effective and economical, interchange standards must prevail.

The Department of Defense is emphasizing and developing such standards. In the last three years, the military has acquired enough experience to evolve standards (see p. 15 of this issue) that are both practical and effective for government and industry.

The miniaturized reproducible in an aperture card is giving USASESA an effective tool to control its technical data. For example, the master data card furnishes the basic information to compile an equipment type number to drawing number index.

The aperture card has also provided more effective control over release issues than was possible under the old system. It now is a basic record that originates information. Hitherto, hand-posting and transcription were needed for the historical file record of issues. Doubt could exist as to whether the clerk had the correct information. With the aperture card, issue changes are easily managed. The aperture card immediately signals whether a release has been duplicated or omitted.

The elimination of drudgery from engineering communication has provided time to plan and to think. Up to now, the job was to keep up with the backlog of filing and distribution. The pressure was on finding people, space and equipment to house and service records of various sizes. So much time was spent on the housekeeping portion of engineering communications that little time was left to plan better uses of such communications.

Because aperture cards require so little space, some of the space savings can be used to provide better service. In housing full-sized intermediates or prints, space becomes so precious that proper filing techniques are difficult to maintain.

At USASESA, this improved control of technical data was made possible by converting engineering communications into a manageable format.

Field Activities' Files

Another illustration of improving engineering communications by better techniques concerns the manufacturers' drawing files. In many instances, field activities did not have this information because it was not practical from the viewpoint of economics and systems to provide it on a routine basis.

Today such files in aperture cards can be maintained economically and practically even at overseas depots. Now, because field activities are self-sufficient in engineering communications, management programs can be planned to take advantage of these new benefits.

To make these field programs possible, an entire new range of point-of-use equipment has become available. In general, the field activities need and use devices to project and print the information in their aperture cards.

Summary

As one of the innovators in improving engineering communications, USASESA is proud to have made its contribution; it is also grateful to have benefited from the experience of other agencies and firms.

No one knows what tomorrow will bring in engineering communications. However, USASESA knows that with its present program it can take advantage of still better ways to distribute and use engineering data.

Graphic Perspective

by Eleanor W. Thompson

SCARCELY 100 years ago — in 1862 — tracing paper became a commodity manufactured for professional drafting use. Tracing cloth was invented in England at about the same time. This durable material was made by coating Irish linen with a wax-like finish.[1] Long-staple Egyptian cotton was subsequently substituted for the linen, in order to produce a more transparent cloth. The process of manufacture is so difficult that even today few manufacturers are able to produce a cloth satisfactory to the U. S. Government —a prime user of tracing cloths.

Tracing papers and tracing cloths were significant in the developing role of the draftsman, because they freed him from much tedious work, while speeding up the business of copying. The appearance of these materials also stimulated a search for mechanical methods of reproducing drawings.

Ferroprussiate Process

EXPERIMENTATION with photography in the first half of the 19th century had revealed that light changes the nature of many chemical substances. The blueprint process, called initially the ferroprussiate process of photography, was discovered by an Englishman, Sir John Herschel, around 1842[2]. A brief description of this process, in which a drawing on tracing cloth or paper takes the place of the negative, may be of interest to draftsmen.

A solution was made by dissolving certain quantities of Citrate of Iron and Red Prussiate of Potash separately in water. Once dissolved, the two solutions were mixed. The blueprint paper was prepared (or sensitized) by sponging it generously on one side—and sparingly on the other—with this solution. The paper was then allowed to dry away from the light.

In use, the sensitized paper was placed on a padded board. The tracing to be reproduced was laid upon it, and this in turn was covered by a glass plate. In order to print, the whole was exposed to the light from 30 to 45 minutes on a clear, sunny day, or for 90 minutes if the weather was cloudy. After exposure, the glass was removed and the copy was washed in clear water. This turned the background a deep Prussian blue, leaving the lines white.

This manual process of blueprinting could be used only when the drawing was quite small, and in actual practice it was often less expensive to continue to have tracers or junior draftsmen make copies of drawings. However, the first blueprint machine was invented about 1907, and by the 1920's the process was widely accepted.

What did this mean to draftsmen? It meant that drawings became plain; fancy borders and ornamentation could no longer be justified. The art of "draughting" became the business of "drafting."

Diazotype Processes

OTHER PROCESSES of reproduction followed, most notable among these the twin diazotype processes, because they resulted in direct-positive reproduction. The reaction resulting in synthesis of diazos (diazotization) was discovered by Peter Griess, a German chemist, in 1858. In 1890, three English chemists—Green, Cross and Bevan—developed the reaction most commonly used today. They discovered that a certain diazo could no longer couple to form dyes after it had been exposed to ultra-violet light. This meant that areas exposed to light through an original tracing would produce white areas in a print, whereas the areas protected from light by an opaque image would produce a dye.

It was not until World War I, however, that a German monk, Father G. Koegel, produced a practical diazotype reproduction process. In 1923, Kalle & Company, a dyestuff plant in Wiesbaden took over Koegel's work, producing the first marketable diazotype paper. It yielded positive maroon images on a white background, when developed in ammonia vapors. At about the same time, the firm of P. Van der Grinten of Venlo, Holland, produced what is commonly known as the "moist developing" diazotype process, which yielded a print with black lines on a white background.

Because the blueprint process had already reached a high state of development, little attention was paid to the diazotype processes when they were first introduced in the U. S. in the late 1920's. However, their positive-printing characteristics eventually brought rapid acceptance. Today, there are over 40 manufacturers of diazotype reproduction materials, and their use now far exceeds that of blueprint and brownprint materials.[3]

Future Trends

HISTORY is still being written in the fields of reproductive techniques and of drafting media—and at a thumping rate. Polyester film,[4] since its introduction in 1953, has become a multi-million-dollar product in the drafting field. And the use of advanced photographic techniques to enlarge and to reduce engineering data is today effecting a further evolution of drawing standards, toward simplicity and legibility.

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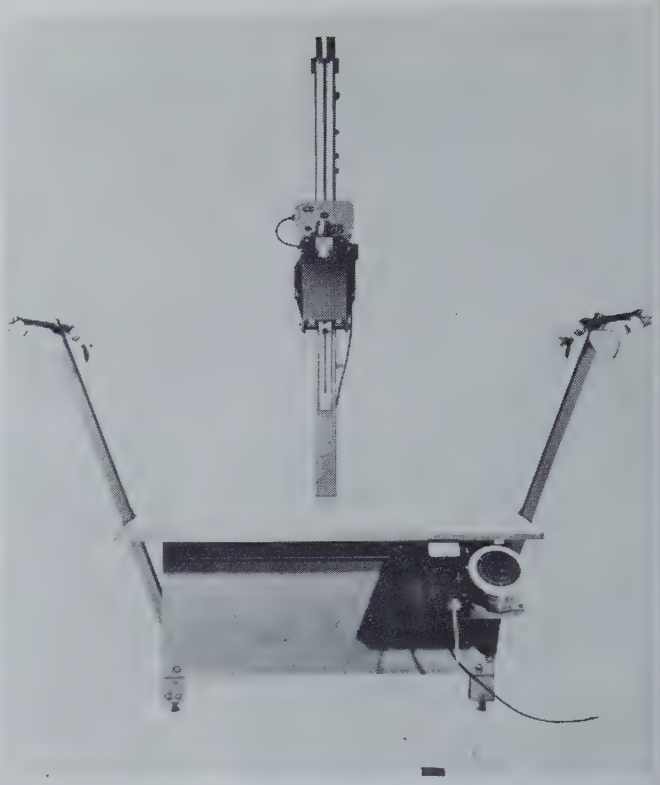
[1] Dard Hunter, "Papermaking, the History and Technique of an Ancient Craft," New York (1947).
[2] Jean Nichol, "Photography," Encyclopedia Americana, 1938.
[3] Information on the diazotype processes was furnished by Technifax Corp., Holyoke, Mass.
[4] Mylar, produced by Du Pont and processed by half a dozen for drafting use.



NINE-POSITION planetary camera microfilms engineering drawings in sizes ranging up to 36″ x 47″ at 29-times reduction.

Microfilm Package Plan

Complete Industrial and Engineering Microfilm Department Offered as Unit

CAMERA, film developer, jackets, and reader—marketed as one unit and at a price said to be less than that of any similar system offering comparable features—is Remington Rand's entrant in the booming microfilm sweepstakes. Known as Film-a-Record Micro-Station Package Plan, it is said to save space, time, and money, while providing good protection for engineering drawings.

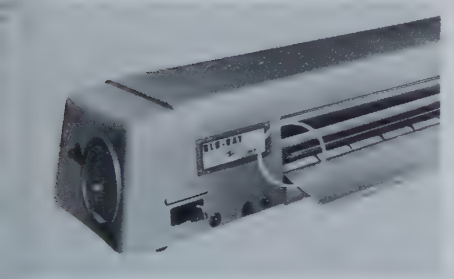
The camera, the F36.1PL (shown above), is a power-driven, 9-position, planetary unit. Document sizes range from 15″ by 21″ at a 12-time reduction, up to 36″ by 47″ at a 29-time reduction. Light meter is included. Sufficient film is supplied to microfilm over 5,000 documents. It is supplied in 100-foot rolls on daylight loading spools. The microfilm processor, called Unipro, automatically develops, fixes, washes, and dries 16mm, 35mm, and 70mm film, interchangeably of any length up to 100 feet. One hundred feet of film can be processed in half an hour. Tailor-made acetate jackets, called Uni-Kards, protect filed individual images—36 to the inch. Each jacket has room for five lines of direct indexing and conforms to the standard MIB size.

Literature describing the package plan is available at Remington Rand branch offices, or by writing to the company at 315 Park Avenue South, New York 10, N. Y.

New Products

Microfilm Readers

Three budget-priced readers called "Draftsman" are offered for microfilm projection. Model 708A is designed to attach to any drafting table and to project the image onto the table from either above or below; it functions satisfactorily in normal room light. Model 708C has a 12½ by 18½-inch screen that projects the full "D" aperture at one time. Model 708P has an improved card holder and optical system for use as a wall projector. All three models are equipped with 300-watt, blower-cooled projection lamps and accommodate the standard "D" (Mil. Spec.) aperture. These microfilm readers are available from Recordak microfilm dealers and from affiliates of Microdealers, Inc., 1560 Trapelo Rd., Waltham 54, Mass. (Recordak Corp., 415 Madison Ave., New York 17, N. Y., is a subsidiary of Eastman Kodak Co.)



Whiteprinters

Budget-priced diazotype copying machines with redesigned printing cylinders are offered in 14-, 27-, and 42-inch printing capacities. These machines, Blu-Ray Whiteprinters, are manufactured by Reproduction Engineering Corp., Essex, Conn. The new printing cylinders are Pyrex, and provide better ultraviolet light transmission than the plastic formerly used; in addition they are not easily scratched. The cylinders may be removed for cleaning. Pick-off bar, circled in photo, is said to further improve operating efficiency.

Vertical Blueprint Safe

As many as 1,000 plans may be stored in a fire-proof, burglar-proof vertical safe. The safe is made by Ever-Safe Co., Lafayette, Ind., and the vertical filing components are supplied by Momar Industries, 4176 W. Montrose Ave., Chicago 21, Ill. Prints are retained on 30-inch long, removable steel plan holders. Thumbnuts on plan holders secure 100 prints each. Prints up to 30 inches wide and 48 inches long may be stored. The safe is equipped with dial combination lock.

Cartridge-Fed Ruling Pen

Ruling pens that substitute throw-away cartridges for the ink bottle are offered with a life-time guarantee. Called Rule-O-Matic, the pens are available from Clover House, P. O. Box 1107, Santa Monica, Calif. Each pen has stainless steel nibs, tempered, sharpened and tested for good ruling characteristics. The cartridge contains enough India Ink for approximately 55,000 inches of ruled lines. The pen is filled by pressing down on the top of the cartridge; no ink gets on the outside of the nib.

Portable Drafting Board

Briefcase-sized board with drafting machine attached permits accurate, scaled drawing in or out of the shop. This portable drafting machine, called Sketch-Faster, is manufactured by Lloyd Tool Corp., P. O. Box 647, Burbank, Calif. The 11 by 13-inch board gives full coverage of standard "A"-size drawings (8½ by 11 inches). Center markers and a ¼-inch grid are provided on the Masonite board. A steel straight-edge, riding on a braided Dacron belt, permits parallel ruling at any angle up to 15 degrees. Plastic carrying case is supplied. The unit retails for $5.

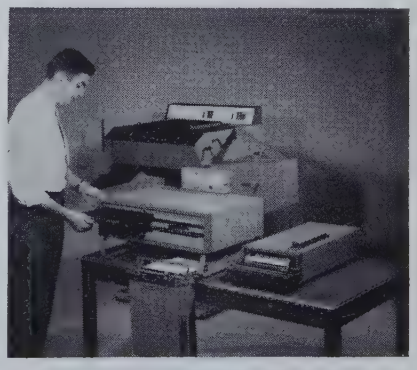


Photo Reproduction System

In two minutes, using a standard copying camera, a method called Ektalith can produce a master from practically any kind of original—printed, typed, written, or drawn on opaque or translucent paper. The master can be either an enlargement, a reduction, or the same size as the original. The master can then be used to print up to 1,000 or more copies on standard offset duplicating equipment, or as many as 10 copies can be made directly from the master without using offset equipment. The Ektalith Method was developed by Eastman Kodak Co., Rochester 4, N. Y., and equipment and materials were introduced to the market in January, 1960. In photo, the operator is returning the paper holder and exposed Kodak Ektalith Transfer Paper, ready for processing in the activator.

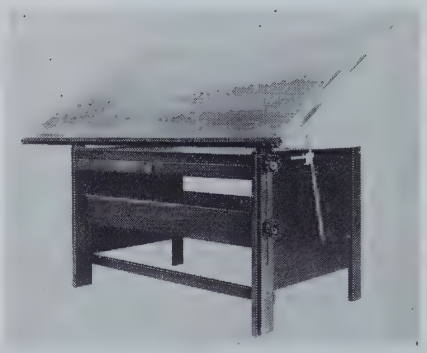
(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)

Projection Papers

Two, high-contrast, direct-positive camera and projection speed papers, with fast, wash-off processing, have been announced by Eastman Kodak Co., Graphic Reproduction Div., Rochester 4, N. Y.

Kodagraph Autopositive Projection Paper, Standard, has the proper high speed for exposure in process camera or enlarger; it can be used in a copying camera for making positive copies of documents, paste-ups, etc. It is also suitable for making flip-charts from 2″x2″ black-and-white transparencies.

Kodagraph Autopositive Projection Paper, Extra Thin, is the same as the Standard paper discussed above, but its thinner base provides the extra translucency desired in intermediates. It is said to be well suited for making reduced-size positive intermediates of engineering drawings with process-type cameras.



Wood Drafting Tables

Tables have been designed with standardized base sizes to permit interchangeability of varying sizes of drafting board tops as the need arises. Recently announced by Anco Wood Specialties, Inc., 71-08 80th St., Glendale 27, N. Y., the Ancowood table is also provided with a bookshelf. A print drawer the full width of the base may be inserted from front or back. The working angle of the board is adjustable to 90° vertical.

Optical Mounter

Center, check and mount—that is said to be all it takes to put microfilmed images into aperture cards, whether from 100- or 1,000-foot 35mm microfilm rolls, using a recently designed semi-automatic optical mounter. Produced by The Filmsort Co., Pearl River, N. Y. (a division of Minn. Mining & Mfg. Co., Inc.), the unit combines motorized microfilm insertion with precision center-line techniques. The operator aligns the center lines of the microfilm frame with those on the mounter screen; in addition, he checks the microfilmed data projected on the screen with the punched or posted data of the aperture card. Film transport and film die travel are motorized and controlled by pushbutton. As the film die returns to its starting position, the next microfilm frame advances automatically. Operator output, depending on the amount of verification procedure, averages between 300 and 400 frames hourly.

Master Grid Kit

The preparation of grids for diazo-printed graphs, intended for use with an overhead projector or portable viewer, is facilitated by using the Technifax Gridmaster Kit, offered by Technifax Corp., 195 Appleton St., Holyoke, Mass. The kit consists of transparent line-masters with vertical and horizontal lines of varying widths, a grid index, opaque pressure-sensitive tape used to form outlines of selected sections of grids, a pin-registration bar for precise alignment of grids and overlays, and a master sheet containing pressure-sensitive headline data. Curves, bars, columns, lettering, etc., may be applied by using tapes, "cold type" or india ink.

Electric Typewriter

Fractional backspacer which can be manually operated, meets the problem of correcting errors skillfully on electric machines. Announced by Remington Rand, Div. of Sperry Rand Corp., 315 Park Avenue South, New York 10, N. Y., the new back-spacer is optional at no extra cost on Remington Electric typewriters.

Microfilm Splicer

Splicing unit, designed for use with non-perforated 16mm microfilm, has been announced by Recordak Corp., 415 Madison Ave., New York 17, N. Y., a subsidiary of Eastman Kodak Co. Called the Recordak Presstape Splicer, the unit utilizes a clear tape to join the splice. The tape is packaged so that the operator does not touch the face of the film to complete the operation. The re-winds shown in photo are an optional accessory.

New Literature

Microfilm Booklet, titled *Let's Take a Positive Look at Microfilm,* is offered without obligation by Minnesota Mining & Mfg. Co., Dept. SO-9, 900 Bush Ave., St. Paul 6, Minn. Reprinted from THE OFFICE magazine, the article is written by Edward Rosse, head of the Social Security Administration's microfilm program—one of the world's largest.

Drafting Supplies Catalog for 1959 may be requested from The Lutz Co., 65 Seventy-First St., Guttenberg, N. J. Specifications for a wide selection of drafting, engineering, and artists' supplies are given. Items are illustrated and prices are included.

Lettering and Symbol Drawing Equipment Catalog, *Leroy Lettering and Symbols,* may be obtained from Keuffel & Esser Co., Hoboken, N. J. Leroy (trade mark of K & E) templates, pens and scribers are described and illustrated. Model numbers for sets, components and accessories are listed.

Fundamentals of SAE Automotive Drafting Practice (SP-67), of value to those not interested in the special automotive sections of TR-66, SAE Automotive Drafting Standard, (reviewed elsewhere in this column), may be ordered from the Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y. Price to members and non-members is $2.50. It contains three new sections: A6, Dimensioning, A7, Geometric Tolerancing, A8, Positional Tolerancing.

Autopositive Materials Pamphlet, (No. Q-23) may be obtained from Eastman Kodak Co., Graphic Reproduction Sales Div., Rochester 4, N. Y. The pamphlet gives specific handling recommendations for the use of Kodak Autopositive Film (Thin Base). With these materials, a negative can be made directly from a negative—or a positive from a positive. This makes practical a large number of operations in multiple-negative work and step-and-repeat operations.

(Copies of the literature reviewed can be obtained directly from the manufacturer or publisher. Complete addresses are included.)

New Literature

Drafting Booklet, *Drawing for Good Reproduction* by Arthur H. Rau, deals authoritatively with the media and techniques affecting the quality of reproducible documents. The basic materials of the drafting room—paper (or drawing media), pencils and erasers—are scrutinized and positive recommendations are made regarding their proper selection and use. Handling and shipping of drawings, drawing rehabilitation, rejuvenation, and preservation and storage are also reviewed. Reproduction processes and materials are covered somewhat briefly, but sufficient information is given to provide a path through the maze of available techniques. The author, Arthur H. Rau, is Consultant-Drafting Engineering Services, General Electric Company, Schnectady, N. Y. Copies of the booklet are available at a cost of one dollar each from the National Association of Blueprint and Diazotype Coaters, 1757 K. Street, N.W., Washington 6, D. C.

35mm Microfilm System brochure, presenting a complete microfilm service which utilizes the Filmsort (tradename) System for engineering drawings and allied records, is available from Graphic Microfilm Corp., 115 Liberty St., New York 6, N. Y., an affiliate of Microdealers.

Sensitized Papers, Cloths and Films, a catalog of dry developed and semi-moist diazotype materials, blueprint and sepia-tone, reproduction cloths, films and papers, and developing solution, is offered by Frederick Post Co., 3650 North Avondale Ave., Chicago 18, Ill. Suggested list prices, keyed to catalog numbers, are also available.

Dry Diazo Whiteprinting Booklet (Form S6-1), titled *Factors Affecting Print Making*, is offered by Paragon-Revolute Corp., 77 South Ave., Rochester 4, N. Y. Printmaking factors discussed are: the original, coating, speeds, exposure speeds, and development. The booklet also deals with making sepia intermediates, making prints on film, handling curled originals, developing lightweight papers, and feeding long originals.

The Book Shelf

ARCHITECTURAL DRAFTING, 3rd Ed., by William J. Hornung. 229 pages, 8½ by 11 inches, over 400 illustrations, Prentice-Hall, Inc., Educational Book Division, Englewood Cliffs, New Jersey ($7.35).

THIS BOOK has much to offer all who live in houses, and to all interested in drawing—architectural or otherwise. Intended as a basic text for the student of architectural drafting in technical or vocational high school, technical institute, or in college, it is a reference also for "students of all ages"—to paraphrase a familiar line.

A primary concern with the construction of the single family residence lends this book its consistent focus. It avoids esoteric discussions like the plague. The result is a concise and eminently practical volume.

Commencing with the chapter on Construction Principles, it proceeds through nine chapters covering such basic considerations as Planning, Standard Details, Heating, Plumbing, Electric Wiring and Specifications. Appended at the back of the book are general tables and listings of such items as joist and rafter sizes, definition of work terms, drafting symbols and common abbreviations found on a set of working drawings.

Following the ancient Chinese proverb that "one picture is worth more than ten thousand words," Mr. Hornung has liberally salted his book with orthographic and three-dimensional illustrations, covering the range of drawing from study sketches through isometric and perspective drawing, and thence to comprehensive working drawings. The arrangement of chapters and illustrations is such that the book constitutes a self-teaching unit. It is a text book that provides a firm two-way bridge between teaching and learning.

In this latest edition of ARCHITECTURAL DRAFTING is new information on insulating houses and on insulation materials, new masonry wall constructions, an introduction to both architectural and mechanical styles of lettering. Plans, elevations and details for both a contemporary split-level house, and for a small industrial building have also been added.

Draftsmen will find the drawings absorbing. House owners will be interested in discovering what is behind the familiar finished walls of their homes. The building trades should find it a sturdy reference. And above all, the student—for whom the book is primarily intended—will find it an effective and enduring self-teaching aid.

The Design-Drafting Council of Delaware Valley

IN THE PAST TWO DECADES the Philadelphia area has become one of national and international importance. This industrial region encompasses not only Philadelphia as such, but the entire surrounding countryside and many cities and towns in three states: Pennsylvania, New Jersey, and Delaware. In local phraseology, it is known as Greater Philadelphia, or just the Delaware Valley Area, referring of course to the waterway that serves it.

IT IS here that we were introduced several weeks ago to the Design-Drafting Council of Delaware Valley. The Council is composed of a group of several hundred drafting supervisors and chief draftsmen who have, for several years now, quietly worked together to improve the level of drafting, drafting supervision and management, and drafting education in the schools, technical institutes and colleges in the area.

As a part of its activities, the Council sponsors monthly luncheon meetings at which a paper may be read by one of the members, has organized a series of 14 lectures given at Temple University by *chief draftsmen* for professors of engineering drawing, drafting, and technical illustration. Why? To let the teachers know what was happening in the industrial drafting rooms in the Delaware Valley! The result of course will be in improved drafting prospects for local industries.

The Design-Drafting Council of Delaware Valley is currently growing faster than its up-to-now informal organization can keep with.

Their recent meeting (an Annual Workshop at which William Healey, General Electric Co., George Schmidt, of Campbell Soup Co., and T. Hruslinski, of Dobbins Vocational School spoke) was the first effort on the part of this group to formally put itself into existence. Under the chairmanship of Kyle Seipp, of Philco, the group discussed the pros and cons of an official organization, then overwhelmingly voted in its favor.

THE AIMS and purposes of the Council, as outlined in the proposed by-laws, include among others, increased communications between individuals with staff, supervisory and training responsibilities, this to be accomplished by (1) exchange of knowledge on various training courses, (2) exchange of knowledge on personnel problems and methods, and (3) exchange of knowledge on technical problems, methods and equipment.

One question still remains, according to Mr. Seipp: Might the efforts of the Design and Drafting Council be shared effectively with chief draftsmen and drafting supervisors in areas outside the Delaware Valley, and if so, how? According to Seipp, the Design and Drafting Council will be happy to share what know-how it has regarding the formation of a working group, if others are interested. You can express your thoughts either by writing to this office or to Joseph D. Dolan, Secretary, Design-Drafting Council of Delaware Valley, P. O. Box 431, Philadelphia 5, Pa.

Advertisers Index

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NEW NON-SLIP CHUCK
holds lead firmly at any length you want. Lead can't be pushed back in barrel, won't twist in sharpener.

NEW SATIN FINISH METAL GRIP
is knurled for easier holding. Its extra length gives you more accurate control with less finger tension.

NEW ANODIZED ALUMINUM BARREL
is unbreakable. And it can't roll off the board because it's hexagon-shaped.

NEW PUSH BUTTON
instantly releases the chuck's grip on the lead at the touch of the thumb. It's colored for quick identification of grade.

ONLY $1.00

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All-metal construction makes it the buy of a lifetime.

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Koh-I-Noor offers draftsmen an important new dimension in a comprehensive line of instruments and accessories meticulously matched to provide new high levels of professional performance, efficiency and convenience.

MODEL NO. 3060: The regular Koh - I - Noor Rapidograph "Technical" Fountain Pen with self-contained automatic filling system, and pocket clip is a standard drafting room tool.

MODEL NO. 3065: A new model with 7 interchangeable drawing point sections, each color-coded to indicate a different line width. Best buy for the professional who requires frequent change of line widths. Each drawing point section complete with airtight refillable ink cartridge. Interchange is accomplished quickly, cleanly. Comes in handy desk top container.

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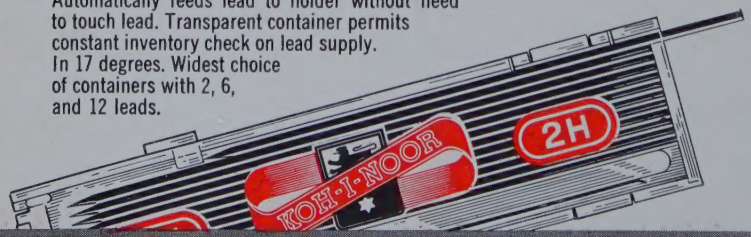
In 7 "color-coded" precision line widths: 00, 0, 1, 2, 2½, 3, 4. Uses India (or regular) ink for ruling, lettering, tracing or writing with equal facility.

(Write for catalog.)

Two Koh-I-Noor products designed to work together...for greater efficiency!

KOH-I-NOOR EJECTOMATIC LEAD DISPENSER

Automatically feeds lead to holder without need to touch lead. Transparent container permits constant inventory check on lead supply. In 17 degrees. Widest choice of containers with 2, 6, and 12 leads.



KOH-I-NOOR ADAPTO-CLUTCH LEAD HOLDERS

Widest choice of holders, all metal, perfectly balanced, with non-slip, turn-proof, replaceable clutch; knurled finger grip. With or without pocket clip, lead degree indicator, Color-Coded.

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